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Engineering Evaluation/Cost Analysis for Scrap Metal Disposition at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

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Tetra Tech, Inc.

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

DOE/OR/07-1880&D2

Engineering Evaluation/Cost Analysis for Scrap Metal Disposition at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Date Issued—November 2000

Prepared by
Tetra Tech, Inc.
under subcontract 23900-BA-ES008

Prepared for the
U.S. Department of Energy
Office of Environmental Management

BECHTEL JACOBS COMPANY LLC
managing the
Environmental Management Activities at the
East Tennessee Technology Park
Oak Ridge Y-12 Plant   Oak Ridge National Laboratory
Paducah Gaseous Diffusion Plant   Portsmouth Gaseous Diffusion Plant
under contract DE-AC05-98OR22700
for the
U.S. DEPARTMENT OF ENERGY

PREFACE

This *Engineering Evaluation/Cost Analysis for Scrap Metal Disposition at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE/OR/07-1880&D2) was prepared to evaluate removal action alternatives in compliance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act. The alternatives considered address the removal and disposition of at least 54,000 tons of scrap metal and miscellaneous materials, which would also support site investigation and remediation of potential contamination underlying the materials. The scrap material addressed by this Engineering Evaluation/Cost Analysis includes scrap material contained in scrap yards C-746-C, C-746-C1, C-746-D, C-746-E, C-746-E1, C-746-H4, C-746-P, C-746-P1, C-747-A, and C-747-B, as well as additional scrap material that may be encountered during the course of this action. The work is performed under Work Breakdown Structure 04.01.02.04.02.07. The objectives of this report are to (1) describe the environmental conditions supporting the need for a removal action, (2) develop and evaluate alternatives, and (3) recommend the alternative that most cost-effectively meet the removal action objectives. This document provides the basis for development of the action memorandum to be subsequently issued.

CONTENTS

FIGURES

TABLES

ACRONYMS

ACM	asbestos-containing material
ALARA	as low as reasonably achievable
AOC	area of concern
ARARs	applicable or relevant and appropriate requirements
BMP	best management practice
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
cfs	cubic feet per second
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EDE	effective dose equivalent
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
EoU	Envirocare of Utah
FFA	Federal Facility Agreement
FY	Fiscal Year
ICRP	International Commission on Radiological Protection
KAR	Kentucky Administrative Regulations
KOW	Kentucky Ordnance Works
KPDES	Kentucky Pollutant Discharge Elimination System
LCF	latent cancer fatality
LDR	Land Disposal Restriction
LLW	low-level waste
MMES	Martin Marietta Energy Systems, Inc.
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
O&M	operation and maintenance
ORO	Oak Ridge Operations
OU	operable unit
PCB	polychlorinated biphenyl
PGDP	Paducah Gaseous Diffusion Plant
PHEA	Public Health and Ecological Assessment
RAOs	removal action objectives
RCRA	Resource Conservation and Recovery Act
S&M	surveillance and maintenance
SWMU	solid waste management unit
TBC	to be considered
^{99}Tc	technetium-99
TEDE	total effective dose equivalent
TI	Transport Index
TSCA	Toxic Substances Control Act
UF_4	uranium tetrafluoride
UF_6	uranium hexafluoride
WAC	waste acceptance criteria
WBS	work breakdown structure
WKWMA	West Kentucky Wildlife Management Area

EXECUTIVE SUMMARY

The Paducah Gaseous Diffusion Plant (PGDP) is an operating U.S. Department of Energy (DOE) facility located in western Kentucky. The plant was operated by Union Carbide Corporation until 1984, when Martin Marietta Energy Systems, Inc. (which later became Lockheed Martin Energy Systems, Inc.), was contracted to operate the plant for the DOE. In July 1993, the United States Enrichment Corporation, which was established by the U.S. Congress, leased uranium enrichment production facilities from DOE and became responsible for production of enriched uranium. DOE maintains ownership of the plant and is responsible for environmental restoration and waste management activities. Since 1998, these activities have been managed by Bechtel Jacobs Company LLC under a management and integration contract with DOE.

Between 1974 and 1983 contaminated equipment was removed from the process buildings at the PGDP as a part of numerous uranium enrichment process (cascade) upgrade programs. These programs included the dismantlement, removal, and on-site storage of contaminated equipment, cell components, and scrap metal from the cascade facilities. Much of the scrap material from this program is contained in several scrap yards located on the northwestern portion of the fenced area of the plant, most of which are located adjacent to each other.

The metal surfaces of much of the PGDP scrap inventory were primarily contaminated with compounds derived from uranium hexafluoride feedstock. In addition to the uranium, trace amounts of technetium, neptunium, and plutonium were detected on enrichment equipment removed from process buildings in the 1970's and 1980's. PGDP site investigations conducted in 1991 and 1992 documented contamination in the vicinity of the scrap yards. A Public Health and Ecological Assessment (PHEA) conducted in conjunction with the 1992 investigation concluded that the scrap yards might contribute to off-site migration of uranium. In addition, the PHEA concluded that off-site migration of uranium may be significant and that exposures in the vicinity of the scrap yards may pose risks to human health. To reduce the potential for uranium-contaminated silt and sediment migration from the scrap yards, an interim action was performed in 1993 to install silt barriers. Since 1993, the silt barriers have been replaced and repaired, and two silt traps were installed during the summer of 2000. An inspection of the scrap yards conducted in May 2000, which included limited radiological scanning of scrap material, confirmed that components stored in the scrap yards are radiologically contaminated. Based on the PHEA, process knowledge, and the recent site inspections, all scrap yards appear to contain contaminated material.

This Engineering Evaluation/Cost Analysis analyzes the following three alternatives: (1) No Action; (2) Continued Interim Action; and (3) Scrap Removal and Disposition with Nickel Ingot Storage. The alternatives were evaluated for effectiveness, implementability, and cost. The removal action objectives (RAOs) are as follows:

- Reduce or remove potential risk and hazards posed to PGDP personnel from exposure to materials at or potentially migrating from deteriorating scrap materials.

- Reduce or remove potential risks and hazards posed to off-site individuals, including residents, recreational users, and workers, from exposure to contaminants potentially migrating from deteriorating scrap materials.

- Reduce or remove the potential risks associated with potential exposures to the environment.

- Facilitate the investigation and potential remediation of the underlying soils and burial grounds that are potentially contributing risks to on-site workers and off-site individuals.

The preferred alternative for this action is Scrap Removal and Disposition with Nickel Ingot Storage. In addition to effectiveness, implementability, and cost, the evaluation included consideration of the condition of the scrap metal, potential for decontamination of the scrap, and disposal options. This alternative includes options for material storage and disposition (e.g., disposal, recycle, etc.). Based on scrap material contamination encountered during initial processing, best management practices will dictate which options are chosen to cost effectively disposition materials in a safe and compliant manner.

Prior to initiation of scrap metal removal, sediment control measures will be designed and constructed and wildlife management provisions put in place to minimize any off-site releases of contamination during the implementation of this removal action. Sediment control measures will include conventional construction methods (e.g., silt fences, hay bales, and gabion structures) as well as the design and construction of a sediment pond capable of containing a 2-year 24-hour storm event. Wildlife management provisions will include the development of a strategy for evaluating the potential ecological impact to and from wildlife in the area. Any sampling will include the development of data quality objectives, which will be done in cooperation with the Kentucky Department of Fish and Wildlife Resources and the U.S. Fish and Wildlife Service.

Based on process knowledge, scrap inventory, and limited contamination information, processing methods have been assumed for the scrap material as part of the overall preferred alternative to assist in the preparation of a cost estimate. Cost of the recommended alternative is estimated at $64,232,000. From approval of the removal action work plan to completion of the removal action report, the action would require 46 months to complete.

1. INTRODUCTION

This Engineering Evaluation/Cost Analysis (EE/CA) documents and describes alternatives for the removal and disposition of contaminated scrap metal and materials from the Paducah Gaseous Diffusion Plant (PGDP) in Paducah, Kentucky. The scrap material includes material contained in scrap yards C-746-C, C-746-C1, C-746-D, C-746-E, C-746-E1, C-746-H4, C-746-P, C-746-P1, C-747-A, and C-747-B, as well as additional scrap material that may be encountered during the course of this action. This document was prepared in accordance with the *Annotated Outline for Engineering Evaluation/Cost Analysis* (DOE 1996).

1.1 SITE DESCRIPTION

PGDP is an operating U.S. Department of Energy (DOE) facility located in western Kentucky (Fig. 1) that includes 748 fenced acres within a DOE reservation of approximately 3,423 acres (Fig. 2). PGDP is in McCracken County in far western Kentucky, approximately three miles south of the Ohio River. The closest communities to PGDP are the unincorporated towns of Grahamville (about one mile to the east) and Heath (about one mile southeast). The closest communities with public water supplies are Kevil, Kentucky (about three miles southwest), and Metropolis, Illinois (about four miles northeast, across the Ohio River). Paducah is approximately 12 miles east of the plant. The population of the greater Paducah area, based on the 1990 U.S. census, is about 27,400. The total population of McCracken County (251 mile^2) is approximately 62,800.

The area surrounding the plant is mostly agricultural and open land, with some forested areas. Homes are scattered along rural roads around the plant. The Tennessee Valley Authority Shawnee Steam Plant, adjacent to the northeast border of the DOE reservation, is the only other major industrial facility in the immediate area. The Allied Signal Plant north of the Ohio River near Metropolis, Illinois, produces feed material for the PGDP.

The PGDP site includes 1,986 acres licensed to the Commonwealth of Kentucky Department of Fish and Wildlife Resources as part of the West Kentucky Wildlife Management Area (WKWMA). The WKWMA is an important recreational resource for western Kentucky and is used by more than 10,000 people each year. Major recreational activities include hunting, field trials for dogs and horses, trail riding, fishing, skeet shooting, and camping.

The plant is in the drainage areas of Big Bayou Creek and Little Bayou Creek, which flows around the western and eastern boundaries of PGDP. The two streams converge about three miles north of PGDP and flow into the Ohio River. Much of the water in both creeks, especially during dry weather, comes from controlled discharges at the plant. PGDP is situated above an aquifer that provides water to private and residential wells. Scrap yards at PGDP cover approximately 25 acres of the northwest corner of the fenced area of the plant. Surface water runoff from the northwestern scrap yards flows into two ditches, which border the northern and western scrap yard boundaries. Flow from the ditches moves westward to Kentucky Pollutant Discharge Elimination System (KPDES) Outfall 001 that discharges into Big Bayou Creek. Surface water runoff from the C-746-D Classified Scrap Yard flows radially from the yard and eventually discharges from KPDES Outfall 010 to Little Bayou Creek.

1.2 SITE HISTORY

Before the PGDP was built, a munitions-production facility, the Kentucky Ordnance Works (KOW), was operated at the current PGDP location and an area southwest of the site. Munitions, including trinitrotoluene, were manufactured and stored at the KOW between 1941 and 1946. The site was shut down immediately after World War II and later became part of the WKWMA. PGDP was constructed from 1951 to 1954, began operating in 1952, and was fully operational by 1955, supplying enriched uranium for commercial reactors and military defense reactors.

PGDP was operated by Union Carbide Corporation until 1984, when Martin Marietta Energy Systems, Inc. (MMES) (which later became Lockheed Martin Energy Systems, Inc.), was contracted to operate the plant for DOE. In July 1993, the United States Enrichment Corporation, which was established by the U.S. Congress, leased uranium enrichment production facilities from DOE and became responsible for the production of enriched uranium. DOE maintains ownership of the plant and is responsible for environmental restoration and waste management activities. Since 1998, Bechtel Jacobs Company LLC has managed these activities under a management and integration contract with DOE.

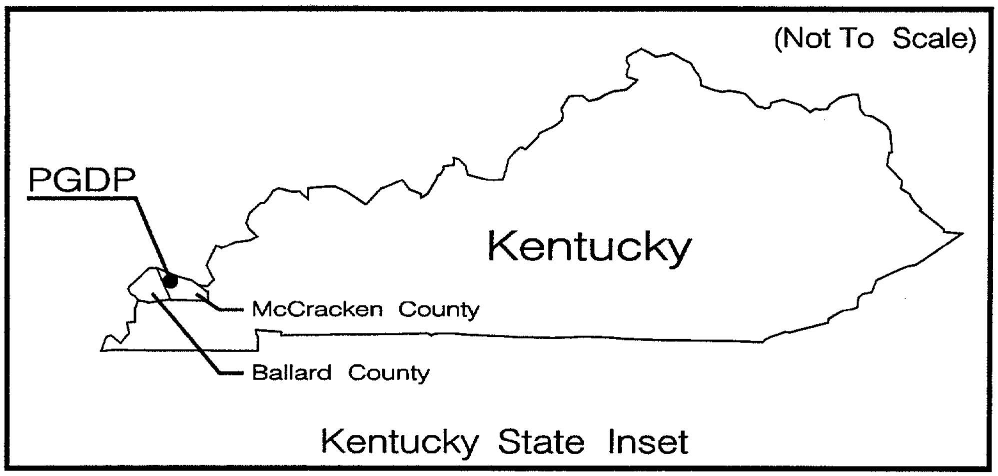
Between 1974 and 1983 contaminated equipment was removed from the process buildings at PGDP as a part of numerous uranium enrichment process (cascade) upgrade programs. These programs included the dismantlement, removal, and on-site storage of contaminated equipment, cell components, and scrap metal from the cascade facilities. Much of the scrap material from this program is contained in several scrap yards located on the northwestern portion of the fenced area of the plant, most of which are adjacent to each other.

Since 1952 when the plant opened, PGDP has amassed large volumes of radiologically contaminated scrap materials in the scrap yards. In addition, Environmental Management and Enrichment Facilities Program activities have generated and are continuing to generate scrap material. Management practices have evolved over time. Early practices included dumping of miscellaneous scrap material in open fields between existing scrap piles. Currently scrap material is segregated and dispositioned into administratively controlled scrap yards.

1.3 PREVIOUS INVESTIGATIONS AND REMOVAL ACTIONS

A two-phased sitewide environmental investigation of the subject scrap yards was conducted in which samples of soil, surface water, sediment, and groundwater were collected (MMES 1991, 1992). As a part of the Phase II Investigation, a Public Health and Ecological Assessment (PHEA) was performed to evaluate risks associated with identified contamination. Information from these investigations pertaining to the scrap yards is summarized in the *Interim Corrective Measures Work Plan for Containment of Scrap Yard Sediment Runoff, Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 1993).

Three of the scrap yards (C-746-C, C-746-E, and C-747-A) were identified during the Phase II PHEA (MMES 1992) as possible sources of uranium, technetium-99, and metal contamination in off-site surface water and sediments. Soil from borings collected at shallow depths from around the scrap yards was found to contain uranium isotopes, technetium-99, chromium, and mercury. Uranium was detected in the surface water runoff from these scrap yards during storm events. Solid uranium tetrafluoride (UF_4, green salt) particulates were seen in the soil around C-746-C, C-746-E, and C-747-A. Surface water samples collected as part of the Phase II Investigation indicated that the contaminated scrap yards might contribute to off-site migration of uranium. The PHEA also concluded that off-site migration of uranium may be significant and that exposures in the vicinity of the scrap yards may pose risks to human health.



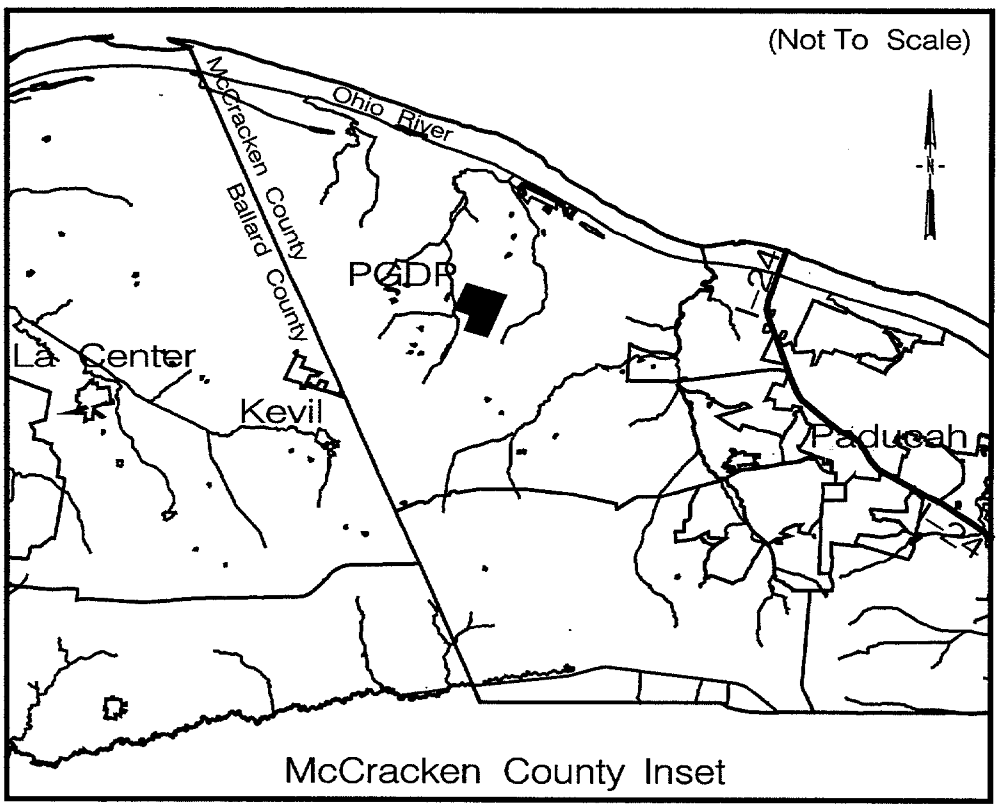


Fig. 1. Regional location map for Paducah Gaseous Diffusion Plant, Kentucky.

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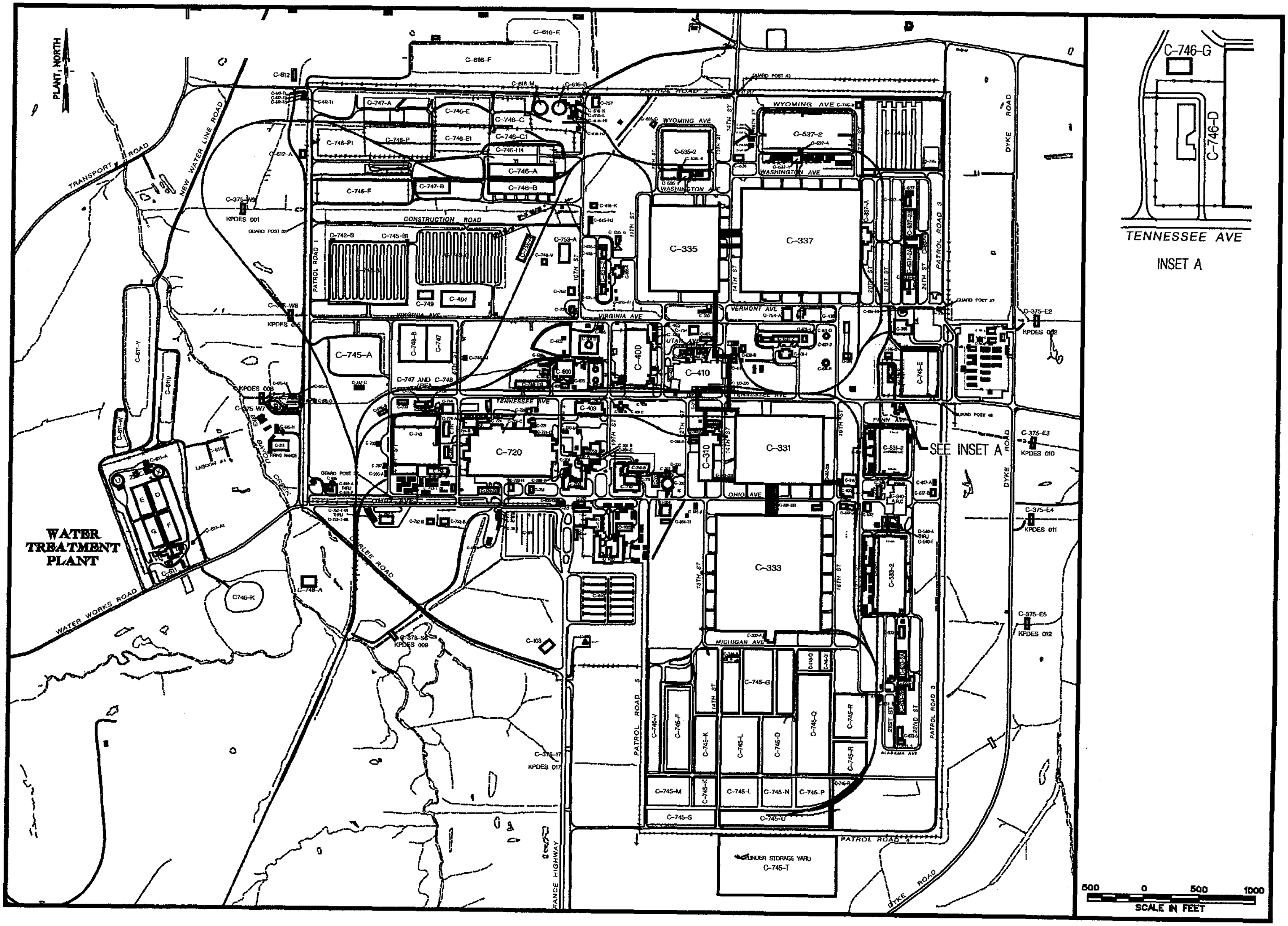

Fig. 2. Paducah Gaseous Diffusion Plant Map.

14

To mitigate the potential for increased risk from transport through drainage ditches, interim actions were proposed in 1993 as described in the Interim Corrective Measures Work Plan (DOE 1993). To reduce the potential for uranium-contaminated silt and sediment migration from the scrap yards, silt fencing was installed in 1993 around the perimeter of the scrap yards. Since installation, a surveillance and maintenance (S&M) program has been in place to monitor the condition of the silt fencing and to correct any disrepair of the fencing when required. Two new silt traps were installed in the summer of 2000. The silt fencing was not intended as a comprehensive solution to soil and sediment migration from the scrap yards.

An inspection of the scrap yards conducted in May 2000, which included limited radiological scanning of scrap material, confirmed that components stored in the scrap yards are radiologically contaminated. In addition, solid UF_4, like that identified in 1991 and 1992 Investigations (MMES 1991, 1992), was observed inside of some scrap material. Based on the PHEA, process knowledge, and the recent site inspections, all scrap yards appear to contain contaminated material.

In September 1999, the Drum Mountain Removal Action was determined to be a high priority activity and was addressed by separate decision documents than those that will address the remaining scrap materials at the PGDP. Removal and disposal of approximately 251,000 cubic feet of radiologically contaminated drums in the C-747-A scrap yard, known as Drum Mountain, began in June 2000 and will be completed in March of 2001.

1.4 NEPA VALUES

DOE issued a "Secretarial Policy Statement on NEPA" (DOE 1994) stating that DOE would thereafter rely on the CERCLA process for review of environmental impacts of actions to be taken under CERCLA and that DOE would address additional NEPA values not traditionally addressed in the CERCLA process by incorporating such values into CERCLA documentation to the extent practicable. Such additional NEPA values may include socioeconomic, cultural, and cumulative impacts, as well as environmental justice and land use issues and the impacts of off-site transportation of wastes. NEPA values considered in the development of this EE/CA include analysis of potential impacts to endangered species, prime farmland, noise levels, and cultural resources. None of the alternatives described in the EE/CA are expected to result in adverse impacts to these resources.

Some of the alternatives considered could result in higher noise levels due to equipment operations and material processing; however, the higher noise levels would be localized during the action to the PGDP site, which is an industrial facility. In addition, transportation of the scrap metal and other wastes to potential processing/disposal facilities would result in transportation noise; however, the resulting transportation noise would be within the range of noise levels that normally occur on the transportation routes.

The state and federal fish and wildlife officials are currently working with DOE to develop a strategy for evaluating the potential ecological impacts to and from the wildlife in the area. Plans for any animal sampling conducted will be detailed in the Removal Action Work Plan. Planning will include the development of data quality objectives, which will be done in cooperation with the Kentucky Department of Fish and Wildlife Resources and the U.S. Fish and Wildlife Service.

Floodplains and wetlands exist on the PGDP site (CDM Federal 1994). It is anticipated that adverse impacts to floodplains, waters of the United States, and wetlands would be avoided for any activities and construction necessary to implement any alternative defined for this removal action. However, if activities might impact one of these resources, location-specific applicable or relevant and appropriate requirements

(ARARs) have been identified in Appendix A, which would have the effect of mitigating adverse impacts from these activities. DOE will comply with such ARARs to the extent practicable.

Anticipated socioeconomic impacts from this removal action would be positive, although incremental, due to increased employment. A risk analysis which primarily addresses potential impacts from off-site transportation of scrap material is provided in Appendix B. Cumulative impacts, such as an increase in local traffic hazards, were also considered. None of the alternatives considered would result in any significant cumulative impacts.

1.5 SOURCES, NATURE, AND EXTENT OF CONTAMINATION

The scrap material addressed by this EE/CA includes scrap material contained in C-746-C, C-746-C1, C-746-D, C-746-E, C-746-E1, C-746-H4, C-746-P, C-746-P1, C-747-A, and C-747-B, as well as additional scrap material that may be encountered during the course of this action. All scrap yards except for C-746-D are located in the northwest corner of the fenced site. The scrap yard layout is shown in Fig. 3. Material placement ranges from unorganized random piles of mixed material types to highly segregated piles of essentially a single material or equipment type.

Gaseous diffusion cascade process and other equipment stored in the scrap yards includes processing equipment, piping, valves, nickel ingots, and miscellaneous scrap metal. The equipment, piping, and valves were made of steel, nickel-plated steel, copper, aluminum, Monel, various bronzes, and miscellaneous metals. Other scrap metal includes mounds of wire, railroad spikes in cans, railroad rails, and drained transformers. Stainless steel is not expected to be present in any appreciable quantities. The scrap metal yards also contain non-metal scrap materials dispersed throughout the scrap metal piles. These materials include wooden cylinder supports, wooden pallets, vehicles, office trailers, and concrete pipe. In addition, the C-746-D scrap yard contains classified materials.

Many of the scrap metal yards are located on top of various solid waste management units (SWMUs). Investigation and remediation of the underlying soils and burial grounds is not within the scope of this project.

1.5.1 Scrap Material Description

Following is a brief description of scrap material addressed by this EECA.

- C-746-C, Contaminated Excess Metal Yard - contains a large segregated scrap metal pile of mostly nickel-plated steel and deteriorated drums containing metal turnings on pallets.

- C-746-C1, Contaminated Excess Metal Yard - contains aluminum compressor fan blades (potentially volumetrically contaminated) and ordnance shipping braces.

- C-746-D, Classified Excess Metal Yard - contains nickel-plated steel, aluminum, compressors, and debris.

- C-746-E, Contaminated Excess Metal Yard - contains converter shells, motor housings, wooden pallets, metal turnings in drums, and vent/duct gaskets potentially containing PCBs.

- C-746-E1, Contaminated Excess Metal Yard - contains piles of aluminum components and piles of nickel-plated steel from process equipment.

- C-746-H4, Nickel Ingot Storage - contains nickel ingots, a small amount of aluminum ingots, some aluminum billets, and steel molds from nickel/aluminum smelting processes.

- C-746-P East, Regulated Yard - contains switchgears (mostly clean—steam cleaned), fuel-fired furnace, mounds of wire [potentially containing PCBs and/or asbestos-containing material (ACM)], small office trailer, railroad spikes in cans, and miscellaneous piles of scrap.

- C-746-P1, Clean Excess Metal Yard - contains scrap, drums, drained transformers, and railroad rails.

- C-747-A, UF4 Drum Yard - contains crushed drums (previously containing UF_4) and autoclaves that are 6 ft in diameter with ends removed. The autoclaves are addressed under this EE/CA. The crushed drums are being removed and dispositioned under the Drum Mountain removal action referenced in Section 1.3.

- C-747-B Yard - contains contaminated forklifts and contaminated wood pallets.

- Additional Scrap Materials - Additional scrap materials, not identified in the inventory, may be identified during the execution of the action. These additional materials would be dispositioned in accordance with the selected alternative.

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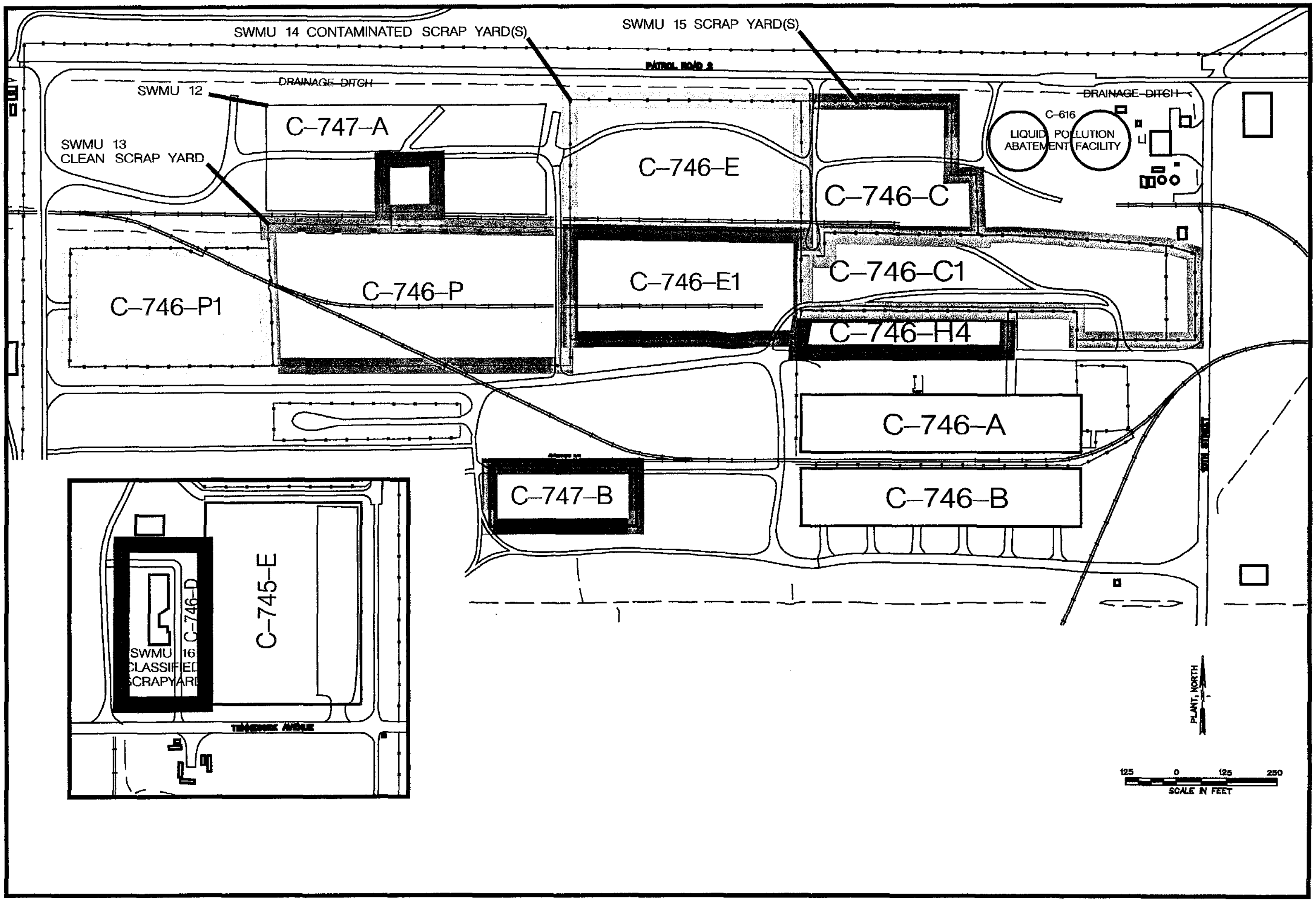

Fig. 3. Scrap metal yards at Paducah Gaseous Diffusion Plant

1.5.2 Scrap Material Inventory

An inventory of the scrap metal at PGDP was performed as part of an effort in the fall of 1994 to identify scrap metal at all DOE facilities. Table 1 provides a summary of the total estimated scrap metal quantities for PGDP identified in the Scrap Metal Inventory Report (DOE 1995) as well as the estimate utilized in the alternatives for costing purposes. A more detailed inventory of the scrap identified in the Scrap Metal Inventory Report (DOE 1995) is included in Appendix C. The values used for cost estimating are revised from those in the Scrap Metal Inventory Report (DOE 1995) for the following reasons:

- To account approximately for scrap yard materials not included in the Scrap Metal Inventory Report (DOE 1995) - Since the fall of 1994, PGDP has continued to add scrap material to the scrap yards. The additional material includes contaminated wood and carbon steel primarily from surplus vehicles, fork trucks, and former DOE Material Storage Areas materials.

- To distinguish between classified and nonclassified scrap material - For estimating purposes, aluminum and carbon steel totals were reallocated, as appropriate, into the classified scrap category.

Table 1. Scrap material inventory (tons)

Scrap metal	Scrap Metal Inventory Report	Estimate for costing
Aluminum	4,580	3,253
Nickel	9,700	9,700
Copper	43	43
Carbon steel	38,601	24,765
Stainless steel	41	41
Classified scrap	-	15,887
Wood	-	542
Totals	52,965	54,231

The Scrap Metal Inventory Report (DOE 1995) presents the amounts of scrap metal on a weight (tonnage) basis. The report does not present the volume (cubic feet) of scrap metal present. Some scrap metal handling/disposal operations are typically based upon a cost per unit volume (dollars/cubic foot) basis. For the preparation of this EE/CA, the measured volume of scrap metal was not available. Therefore, estimated density conversion factors were used to estimate the volume of scrap metal present based upon the estimated weights presented in the Scrap Metal Inventory Report (DOE 1995). The density conversion factors used for both metal and non metal scrap material are included in the cost estimate assumptions in the cost appendix.

1.5.3 Scrap Metal Contamination

Although wet chemical decontamination was performed on most of the scrap metal to remove uranium and ^{99}Tc before the scrap metal was placed in the scrap yards, there are no confirmatory data to prove the effectiveness of that process (Keeling 1995). Wet chemical decontamination consisted of a spray wash using soda ash, or sodium carbonate, and water. A 5% nitric acid solution was also used in limited quantities. Process knowledge suggests that some scrap metal may be potentially contaminated with PCBs or ACM as well as by radionuclides.

Much of the metal surfaces of the PGDP scrap inventory were contaminated with uranium compounds derived from uranium hexafluoride (UF_6) feedstock. In addition to the uranium, trace amounts of technetium, neptunium, and plutonium were detected on enrichment equipment removed from process buildings in the 1970's and 1980's. Sampling results are consistent with process knowledge information.

Routine radiation and contamination surveys are performed in and around the scrap yards. No health physics survey data on the actual scrap metal are available. However, the scrap yards, with the exception of C-746-P1, are currently managed as radiation areas. Characterization of the scrap materials will be an integral part of any action.

1.5.4 Nonmetal Contamination

Characterization data on the contamination of the nonmetal scrap material does not exist. Due to the location of this material in areas posted as radioactive contamination areas, it is assumed to be radiologically contaminated. There is also a potential that some of the nonmetal scrap material is contaminated with PCBs, ACM, and/or RCRA regulated substances.

1.6 COMMUNITY PARTICIPATION

Community involvement is a critical aspect of the CERCLA process. DOE is conducting community relations activities for this project in compliance with 40 CFR 300.415(m)(1), (m)(3), and (m)(4) and the DOE-approved community relations plan, *Community Relations Plan for the Environmental Management and Enrichment Facilities Program, Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 1998). Community relations activities related to this removal action will include, but are not limited to, the following:

- development and distribution of fact sheets as needed;
- appropriate press releases to local media on the project status;
- public meetings, availability sessions, or workshops as deemed necessary;
- distribution of appropriate information materials to the established community mailing list; and
- involvement of the public in the decision-making process (i.e., issuance of the EE/CA for public review and comment).

2. REMOVAL ACTION OBJECTIVES

This chapter addresses DOE's response authority under CERCLA for removal actions and identifies the scope, purpose, and general removal action objectives (RAOs) for this removal action. Justification for the removal action and the ARARs are also addressed.

2.1 RESPONSE AUTHORITY

PGDP was placed on the National Priorities List in 1994. Section 120 of CERCLA required the negotiation and implementation of the PGDP Federal Facilities Agreement (FFA) that provides the regulatory strategy for site CERCLA actions.

Section 104 of CERCLA addresses releases or threatened releases of hazardous substances to the environment through response action. Executive Order 12580, "Superfund Implementation," delegates to DOE the authority for response actions for DOE facilities. As lead agency, DOE is authorized to conduct response measures (e.g., removal actions) under CERCLA.

2.2 SCOPE AND PURPOSE

The purpose of this EE/CA is to evaluate alternatives to address the potential threat posed to human health and the environment from the release or potential release of hazardous materials found in the scrap yards discussed above. The scrap yards are located in two areas of PGDP. The first area, on the northwestern portion of the plant, is bounded by 10th Street on the east, Patrol Road 2 to the north, and a drainage ditch south of Bldg. C-746-B. Specific scrap yards included in this area are C-746-C, C-746-C1, C-746-E, C-746-E1, C-746-H4, C-746-P, C-746-P1, C-747-A, and C-747-B. The second area is bounded within Patrol Road 3, Tennessee Avenue, 16th Street, and Vermont Avenue on the northeastern side of the plant and includes the C-746-D Classified Scrap Yard.

The RAOs that have been established are as follows:

- Reduce or remove potential risks and hazards posed to PGDP personnel from exposure to materials at or potentially migrating from deteriorating scrap materials.
- Reduce or remove potential risks and hazards posed to off-site individuals, including residents, recreational users, and workers, from exposure to contaminants potentially migrating from deteriorating scrap materials.
- Reduce or remove the potential risks associated with potential exposures to the environment.
- Facilitate the investigation and potential remediation of the underlying soils and burial grounds that are potentially contributing risks to on-site workers and off-site individuals.

2.3 JUSTIFICATION FOR THE PROPOSED ACTION

The scrap material, which is the subject of the EE/CA, has been identified as an area of concern under the Paducah Federal Facility Agreement due to the potential for actual or threatened releases of hazardous substances from the site. Additionally, the scrap material is believed to potentially overlie several burial grounds that may also present actual or threatened releases into the environment. Therefore, in order to initiate mitigation of these hazards, the FFA contains an enforceable commitment for submitting an EE/CA and establishes requirements for submitting subsequent decision documents and work plans. While it is DOE's objective to expedite removal of the scrap metal, the parties of the FFA have established a goal of complete removal by the end of Fiscal Year (FY) 2005.

2.4 COMPLIANCE WITH ARARs

In accordance with the National Oil and Hazardous Substances Pollution Contingency Plan, DOE on-site removal actions conducted under CERCLA are required to attain ARARs to the extent practicable, considering the scope and urgency of the action [40 CFR 300.415(j)]. In addition to ARARs, other to-be-considered (TBC) information may be used in developing CERCLA response actions [40 CFR 300.400(g)(3)]. ARARs and TBCs that might apply to this action are provided in Appendix A.

Based on knowledge of the processes conducted at the PGDP, all scrap will be considered potentially radiologically contaminated unless characterization demonstrates otherwise. There is the possibility that wastes defined by Toxic Substances Control Act (TSCA) and/or Resource Conservation and Recovery Act (RCRA) may be discovered during the implementation of this removal action. In the event that any TSCA and/or RCRA wastes are identified during the removal action they will be compliantly managed. ARARs that address handling, storing, shipping, disposing, etc., of TSCA- or RCRA-regulated wastes, low-level waste (LLW), or ACM, are identified in Appendix A.

3. REMOVAL ACTION TECHNOLOGIES AND DEVELOPMENT OF ALTERNATIVES

This chapter identifies the applicable representative technologies and alternatives that will be considered for the removal action. Analyses of the alternatives considered are presented in Chap. 4.

3.1 TECHNOLOGY IDENTIFICATION AND SCREENING

Technology areas reviewed included (1) characterization techniques; (2) handling, segregation, sizing, and volume reduction techniques; (3) surface decontamination techniques; (4) packaging options; (5) shipping and transportation options; (6) disposal options; (7) storage options and (8) sedimentation control measures. A technology screening matrix is included in Appendix D.

3.1.1 Characterization Techniques

Appropriate disposition options for the scrap metal would be based on characterization of radiological and chemical contaminants associated with the scrap metal. Screening/surveying for radiological contamination as well as the identification of hazardous or other (e.g., TSCA) contaminants, would be necessary. In addition to the scrap metal, it would be necessary to properly characterize the nonhazardous nonmetallic materials, hazardous nonmetallic materials, wood, and a variety of other nonmetallic materials. Representative sampling of the materials and automated radiological screening techniques could offer significant cost and time savings in the characterization process. Options for performing characterization include the following:

- Process knowledge
- Visual examination
- On-site/field testing
- Laboratory testing
- Automated radiological screening

3.1.2 Handling, Segregation, Sizing, and Volume Reduction Techniques

An important element for the proposed removal alternative includes handling, segregation, sizing, and volume reduction of the bulky scrap metal items. The scrap metal may have to be sorted and sized to meet the requirements for disposition. Volume reduction can allow for the use of automated radiological screening equipment, the loading of bulky objects into readily available shipping containers, compliance with waste acceptance criteria (WAC), and the reduction of disposal costs, which are based on volume. The use of commercially available equipment would accelerate the process of handling, segregating, sizing, and volume reducing the scrap metal. Labor saving devices would reduce the costs and time for the scrap metal processing. Options for handling and segregation include but are not limited to:

- Bucket loaders – track and rubber tired
- Cranes
- Electromagnet-equipped cranes
- Forklifts
- Trucks and transport wagons

Sizing and volume reduction options include but are not limited to:

- Arc saws
- Abrasive cutters
- Abrasive water jets
- Circular cutting saws – clam shell lathe or rotary cutter
- Compaction and baling equipment
- Mobile shears
- Nibbler/shear
- Plasma arc torch
- Oxyacetylene torch
- Shredders

It is anticipated that use of work methods involving torches, open flames, and burning would be tightly restricted to minimize the potential for fires, volatilization of contaminants, and health and safety issues.

3.1.3 Surface Decontamination Techniques

For a limited amount of surface-contaminated scrap metal it may be cost effective to decontaminate the scrap metal to meet the surface release criteria for appropriate disposition. Potential surface decontamination methods include washing the surfaces with water and surfactants to remove the contamination, using abrasive processes to remove a thin layer of the surface material including the surface contamination, and using chemical processes to chemically bind with the contaminant or to chemically remove the surface of the material including the surface contamination. The decontamination processes would generate secondary wastes such as wastewater, abrasive blasting media, decontamination chemical wastes, air and water filtration media, and personal protective equipment. Such wastes have to be properly characterized, packaged, treated, and disposed in accordance with the ARARs and TBCs that apply to the wastes. Some decontamination techniques would tend to create additional health and safety risks that require proper mitigation (e.g., minimizing and controlling airborne contaminants from abrasive blasting operations) while other decontamination methods would minimize generation of secondary wastes (CO_2 pellet blasting). The selected decontamination technique would optimize effectiveness, safety, and cost while limiting the amount of secondary waste generated. Options include but are not limited to:

- CO_2 pellet blasting
- Dry grit blasting
- Electropolishing
- Foam/sponge blasting

- Grinding/honing
- High pressure water/steam blasting
- Hydrochloric acid
- Ice blasting
- Laser etching/ablation
- Liquid abrasive blasting
- Manual brushing/wiping/scrubbing/vacuuming
- Nitric acid
- Organic acids
- Oxalate peroxide
- Plastic bead blasting
- Rotating brushes/honing
- Scabbling/scarifying
- Soda blasting
- Shot blasting
- Strippable coatings
- Ultrasonic vibration

3.1.4 Packaging Options

Packaging and/or containerization of the scrap metal for shipping to a receiving facility would be another required activity to achieve the objectives of this removal action. Applicable transportation ARARs and disposal facility WAC requirements would dictate the specific container requirements. Classification requirements would also dictate requirements for packaging and shipment of classified materials. Some materials, such as scrap metal and debris eligible for disposal in the PGDP Solid Waste C-746-U Landfill, may not require packaging/containerization. Options include but are not limited to:

- Plastic wrapping of pallets
- Concrete casks
- Fixative/stabilizer coatings
- Intermodal containers
- Roll-off containers
- Sealand containers
- ST-5 boxes (B-25)
- Drum, polyethylene
- Drum, steel (55 gal)
- Drum, steel (85 gal)

3.1.5 Shipping and Transportation Options

It could be necessary to transport the processed and packaged scrap material to appropriate facilities for disposition. Transportation of all materials would comply with the applicable transportation ARARs. The mode of transportation would depend on the material being transported, contamination (radiological and chemical) levels, cost, intended destination, and transportation ARARs. Classification requirements could also dictate requirements for shipment and transportation of classified materials. On-site processing, including volume reduction, of the scrap metal could result in less transportation trips, lower mileage, and lower costs than transporting bulk, unprocessed (no volume reduction) scrap metal to centralized off-site processing facilities. Options to be considered are:

- Trucks
- Rail cars
- Barges

3.1.6 Disposal Options

Both commercial and U.S. Government disposal facilities were identified for potential disposal of RCRA hazardous wastes, PCB wastes, low level radioactive wastes, mixed wastes, and classified, low-level radioactive wastes generated by this removal action. The types of waste disposal to be considered are:

- Sanitary/industrial waste disposal
- Low-level radioactive waste disposal
- Classified waste disposal
- Mixed low-level radioactive waste disposal
- Hazardous waste disposal

Selection of the disposal facilities would depend on meeting the disposal facilities WAC, disposal costs, and transportation costs. In addition, the facility must have sufficient disposal capacity to receive and dispose of the contaminated scrap and wastes. Additional discussion on the potential disposal facilities for the waste from the removal action includes the following:

- PGDP C-746-U Solid Waste Landfill is an engineered, solid waste landfill equipped with a multi-layer liner system designed to prevent landfill leachate from leaking from the landfill and entering the groundwater. The landfill is equipped with a leachate collection and handling system for proper management of the landfill leachate; operating and maintenance procedures to facilitate proper operation of the facility; a multilayer final cover system designed to minimize infiltration of water and prevent erosion and exposure of the waste; and a post-closure care period. The landfill is owned by DOE and may be used for disposal of certain non-RCRA, non-PCB solid wastes. The C-746-U Landfill WAC, as presented in *Waste Acceptance Criteria for the Department of Energy Treatment, Storage, and Disposal Units at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (Bechtel Jacobs 1999), indicates that "bulky metal objects" are precluded from disposal in the landfill. Therefore, scrap metal and material from this removal action would have to be appropriately size reduced to facilitate disposal in the landfill under the WAC. Classified wastes cannot be sent to this facility.

- PGDP CERCLA Waste Disposal Facility is a potential on-site disposal facility that may be considered as part of a proposed CERCLA evaluation of a sitewide waste disposition strategy for PGDP. If constructed, the facility would be a candidate for disposition of the contaminated scrap metal and wastes from this removal action.

- Envirocare of Utah (EoU), which is a commercial facility in Clive, Utah, may be used for the disposal of low-level radioactive waste under a contract managed by the DOE Field Office in Miamisburg, Ohio, and for the disposal of mixed waste (RCRA waste with radiological contamination) under a contract managed by the DOE Oak Ridge Operations (ORO) Office in Oak Ridge, Tennessee. Significant volumes of low-level radioactive waste and mixed waste under the jurisdiction of the DOE-ORO have been successfully disposed in EoU. Classified wastes cannot be sent to this facility.

- Hanford Site, which is located in Washington and is owned by DOE, may be used for the disposal of low level radioactive waste and classified low level radioactive waste. The State of Washington will not allow acceptance of out-of-state mixed waste at the Hanford Site.

- Nevada Test Site (NTS), which is located in Nevada and is owned by DOE, is a potential disposal facility for low level radioactive waste and classified low level radioactive waste. DOE's Oak Ridge facilities recently received approval to ship low-level radioactive waste and classified low-level radioactive waste to NTS for disposal. It may be feasible to ship low level radioactive waste and classified low level radioactive wastes from this removal action for disposal at NTS. The State of Nevada will not allow acceptance of out-of-state mixed waste at NTS.

3.1.7 Storage Options for Nickel Ingots

Volumetrically contaminated nickel ingots may have potential economic value. Potential future restricted and/or unrestricted reuse of the nickel ingots would require interim storage (for an assumed period of 30 years) of the ingots in a storage facility. The storage facility would be required to comply with ARARs and TBCs applicable to the storage of materials volumetrically contaminated with low levels of radioactive contamination. ARARs and TBCs are listed in Appendix A. Potential storage options include but are not limited to:

- Available PGDP buildings
- Rubberized tent structures
- Pre-fabricated metal buildings
- Tumulus/bunker facility

3.1.8 Sediment Control Measures

Sediment control measures will be needed to limit migration of contamination during implementation of the removal action. Potential options include but are not limited to:

- Sedimentation basins using gravity settling
- Sedimentation basins using enhanced settling
- Coagulation/flocculation/sedimentation in a treatment plant
- Filtration
- Silt fences, hay bales, and gabions

Whatever measures are employed would need to control and reduce the amount of suspended solids that exit the scrap yards. Measures employed during the recent drum mountain removal action, conducted primarily during the summer months, were successful in limiting sediment transport. Measures were so successful that not enough sediment could be collected for analysis by overseeing Commonwealth of Kentucky officials. It is noted, however, that seasonal weather conditions could increase the potential for runoff. Existing silt fences and traps would be maintained throughout the removal action process. Enhancement of the methods employed during the drum mountain removal action would provide for even greater control of suspended solids. Scheduling of activities as well as work area design considerations and work practices, to be detailed in the removal action work plan, will be important factors affecting the mobility of suspended solids. Removal of the classified aluminum ingots from the C-746-D Classified Scrap Yard will not require sediment control provisions since the ingots are stored on a concrete pad and work activities will not have the potential to mobilize sediment. An evaluation of sediment control alternatives is detailed in Appendix E.

3.2 DEVELOPMENT OF ALTERNATIVES

This EE/CA provides a description of the alternatives being considered for the removal action. Some of the technologies identified in Sect. 3.1 are combined to form these alternatives. The alternatives being considered include (1) No Action, (2) Continued Interim Action, and (3) Scrap Removal and Disposition with Nickel Ingot Storage.

The alternatives developed in this EE/CA serve as the basis for the preparation, analysis, and comparison of cost estimates for implementation of the alternatives. The actual specific methods employed in executing the scrap removal and disposition would be selected by a removal action subcontractor through a competitive bidding process prior to execution of the removal action.

3.2.1 No Action Alternative

The No Action alternative (Alternative 1) would involve no action for the scrap metal yards. The scrap metal would remain in its present state at its present location. S&M activities would end and interim corrective actions would be terminated.

3.2.2 Continued Interim Action Alternative

The Continued Interim Action alternative (Alternative 2) includes the continuation of interim corrective measures and storage of scrap metals and incidental scrap materials. S&M activities consist of routine health physics monitoring, road and fence maintenance, silt fence maintenance, and monthly inspections.

3.2.3 Scrap Removal and Disposition with Nickel Ingot Storage Alternative

The Scrap Removal and Disposition with Nickel Ingot Storage alternative (Alternative 3) includes options for material storage and disposition (e.g., disposal, recycle, etc). Based on scrap material contamination encountered during initial processing, best management practices will dictate which options are employed to cost effectively disposition scrap materials in a safe and compliant manner. Prior to initiation of scrap metal removal activities, sediment control measures (sediment basin and conventional construction methods) would be designed and constructed and wildlife management provisions put in place to minimize any offsite releases of contamination during the implementation of this alternative. Scrap material processing would include the removal of all scrap material visible at ground surface. Scrap material would be inspected, sorted, and segregated. If found, potential RCRA hazardous, PCB, and ACM wastes would be segregated along with any generated regulated wastes for separate processing. Nickel ingots stored at the C-746-H4 Scrap Yard would be relocated and stored in an enclosure within the PGDP security fences in a manner that would preclude contamination migration. In the event it is determined that some scrap is appropriate for recycle, it will be handled in accordance with DOE Order 5400.5 taking into consideration NUREG-1640, U.S. Environmental Protection Agency, Office of Radiation and Indoor Air, *Evaluation for Recycling of Scrap Metals From Nuclear Facilities*, March 1997, and IAEA-TECDOC-855, International Atomic Energy Agency, *Clearance Levels for Radionuclides in Solid Materials*, January 1996. Other materials would be processed and packaged for disposal in accordance with an appropriate disposal facility's waste disposal requirements and to meet U.S. Department of Transportation (DOT) shipping requirements.

4. ANALYSIS OF ALTERNATIVES

In this chapter, an analysis of the alternatives discussed in Chap. 3 is presented with the criteria for evaluating the performance of the alternatives. In Sect. 4.1, the alternatives are evaluated against each criterion. A comparison of the alternatives is presented in Sect. 4.2.

4.1 ANALYSIS OF INDIVIDUAL ALTERNATIVES

The U.S. Environmental Protection Agency (EPA) *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA* (EPA 1993) proposes three criteria for the evaluation of removal action alternatives. These criteria are effectiveness, implementability, and cost. The following sections present analyses of the alternatives based on these three criteria.

Effectiveness evaluates the capability of a removal action to meet the goals and scope of the action. Each alternative is evaluated against two broad rules: (1) protectiveness and (2) achievement of removal objectives. The successful alternative must be favorably evaluated for the following criteria:

- <u>RAOs</u> - assess each alternative's ability to meet the RAOs established in Chap. 2.

- <u>Overall Protection of Human Health and the Environment</u> - assess how the alternative achieves adequate protection and describe how the alternative would reduce, control, or eliminate risks at the site through treatment, engineering controls, or institutional controls.

- <u>Long-Term Effectiveness and Permanence</u> - assess the ability of the treatment technologies to reduce the principal threats posed by the potentially contaminated scrap metal. These criteria address the magnitude of residual risks at the site after the remedial efforts are complete; the adequacy and reliability of in-place controls; and long-term environmental and cumulative effects.

- <u>Reduction of Toxicity, Mobility, or Volume Through Treatment</u> - assess the extent to which the toxicity, mobility, or volume of the contaminants is reduced. There is a statutory preference under CERCLA for removal actions that use treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous and radioactive substances.

- <u>Short-Term Effectiveness</u> - assess any threats to site workers and the effectiveness and reliability of protective measures that would be taken during the remedial action.

For implementability, the following three factors were used to assess how realistic a removal alternative is in practice: (1) technical feasibility, (2) administrative feasibility, and (3) availability of resources. For a successful implementation of an alternative, the following items must be favorable:

- <u>Ability to Construct and Operate Technologies</u> - potential construction and operating problems are presented. Some potential difficulties could include the frequency or complexity of equipment maintenance or controls, the need for raw materials, the need for a large technical staff, and environmental effects.

- <u>Availability and Reliability of Technologies</u> - each alternative is evaluated for technology maturity and prior use under similar conditions for similar wastes.

- Availability of Treatment, Storage, and Disposal Services and Capacity - it must be determined whether treatment, storage, and disposal capacity, equipment, personnel, services, materials, and other resources necessary to implement an alternative would be available in time to maintain the removal schedule.

Finally, the alternative is evaluated to determine capital costs and operation and maintenance (O&M) costs. In this report, an operational life of 30 years is assumed for cost estimating purposes. Detailed cost estimates for each of the alternatives considered are presented in Appendix F.

- Capital costs - comprised of, for instance, the expenditures associated with construction, equipment and materials, land and buildings, relocation and transportation, analytical and treatment services, disposal services, engineering and design, legal fees, mobilization and demobilization, and contingencies.

- O&M costs - includes facility operations, maintenance, monitoring, and ongoing treatment operations.

4.1.1 No Action Alternative

The No Action alternative would be ineffective in meeting any of the RAOs stated in Chap. 2. The alternative would not provide for overall protection of human health or the environment because the scrap material would remain at the scrap yards, S&M activities would cease, and interim corrective actions would be terminated. In addition, there would be no reduction in contaminant toxicity, mobility, or volume because the potential source of contamination would remain. Contaminant mobility would continue. The response objectives would not be achieved. There would be no cost for implementing the No Action alternative.

4.1.2 Continued Interim Action Alternative

The Continued Interim Action alternative would be slightly effective in meeting some of the RAOs stated in Chap. 2. The alternative would not provide for long-term overall protection of human health or the environment because the scrap material would remain at the scrap yards. Some protection of the environment and decreased contaminant mobility is provided by maintaining silt fences; however, ongoing S&M and monthly site inspections are necessary to sustain erosion control provisions. Worker contact with contaminated material and exposure potential remains as a result of continued S&M activities. There would be no reduction in contaminant toxicity or volume because the potential source of contamination would remain. The response objectives would not be achieved. The action is fully implementable, as it would involve continuation of ongoing activities. Total costs for the Continued Interim Action alternative are estimated at $9,230,000 (which consists of the annual costs to perform the present level of O&M for 30 years).

4.1.3 Scrap Removal and Disposition with Nickel Ingot Storage Alternative

The Scrap Removal and Disposition with Nickel Ingot Storage alternative would be effective in meeting the RAOs described in Chap. 2 because, after completion of the removal action, it prevents personnel exposure and migration of contaminants by removing the scrap metal from the site. Also, the removal action would provide for overall protection of human health and the environment and is expected to comply with ARARs. Short-term personnel exposures could be greatly increased during implementation but would be mitigated in accordance with As Low As Reasonably Achieved (ALARA) principles. Long-term effectiveness and permanence would be achieved through removal of the contaminated scrap materials to ground level, disposition of the contaminated materials in an appropriate facility, and continued upkeep of the interim storage facilities for the nickel ingots. Technologies to implement the action are readily available and reliable. Materials would be processed, packaged, and dispositioned in accordance with the WAC for the receiving disposal facility. Nickel ingots stored at the C-746-H4 Scrap Yard would be relocated and stored within the PGDP security fences. In addition, volume reduction is possible via inspecting, sorting, segregating, and dispositioning. All recommended disposal facilities are available and have adequate capacity to accept each waste stream, as appropriate. Certain potential wastes, such as PCB low-level radioactive wastes, classified RCRA/PCB wastes, and classified mixed wastes would be temporarily stored in on-site facilities until a disposal option becomes available. Capital and O&M costs are $61,623,000 and $2,609,000, respectively. Total costs are estimated at $64,232,000.

4.2 COMPARATIVE ANALYSIS OF ALTERNATIVES

The following sections present a comparison of the alternatives based on the effectiveness, implementability, and cost criteria. A summary of the comparisons is shown in Table 2.

4.2.1 Effectiveness

The Scrap Removal and Disposition with Nickel Ingot Storage alternative was evaluated as the most effective alternative because all the materials would be removed from the scrap metal yards as well as additional scrap material that may be encountered during the course of this action. The Continued Interim Action alternative provides minimal protection to the environment via utilization of erosion control provisions. However, the source contamination remains, and continued S&M provides the potential for additional future worker exposure. The No Action alternative does not meet any of the effectiveness criteria.

4.2.2 Implementability

All of the alternatives considered can be implemented. The No Action alternative would rank highest in implementability since it requires no further work. The Continued Interim Action alternative would also rank high in implementability since it only requires continuation of current S&M activities. The Scrap Removal and Disposition with Nickel Ingot Storage alternative would be the most difficult to implement because this alternative would involve scrap material processing, characterization, and either storage or disposition (e.g., disposal, recycle, etc.). However, it is also implementable because there is available technology to process the scrap material and construct storage facilities; adequate disposal capacity is also available.

4.2.3 Cost

The No Action alternative would be the least expensive to implement. The Continued Interim Action alternative would be the second most costly removal action at $9,230,000. The Scrap Removal and Disposition with Nickel Ingot Storage alternative would be the most expensive action at $64,232,000.

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Table 2. Alternative comparisons

Criteria	No Action Alternative	Continued Interim Action Alternative	Scrap Removal and Disposition with Nickel Ingot Storage Alternative
		Effectiveness	
RAOs	Does not meet	Does not meet	Meets
Overall Protection of Human Health and the Environment	Not protective	Minimally protective	Protective • Major source of contamination and personnel exposure removed and appropriately dispositioned (e.g., disposal facility, recycling, etc.).
Long-Term Effectiveness and Permanence	Not effective • Source of contamination remains on the site. • No institutional controls to protect spread of contamination via runoff.	Minimally effective • Institutional controls reduce spread of contamination. • Ongoing S&M required to ensure effectiveness. • Source of contamination remains on the site. Personnel exposure potential remains. • Nickel ingots remain in unprotected environment.	Effective and moderately permanent • All scrap material removed from site. • Nickel ingots relocated to protective, temporary storage.
Reduction of Toxicity, Mobility, or Volume of Contamination Through Treatment	No reduction	Slight reduction in mobility only • Maintain silt fence.	Reduction of mobility and volume • Although no chemical treatment to remove contaminants beyond surface decontamination, volume reduction achieved through commercially available methods.

31

R5004991

32

Table 2. *Alternative comparisons* **(continued)**

Criteria	No Action Alternative	Continued Interim Action Alternative	Scrap Removal and Disposition with Nickel Ingot Storage Alternative
Short-Term Effectiveness	No short-term impacts	Minimal short-term impacts • Source of contamination remains on the site. • Institutional controls reduce spread of contamination. • Nickel ingots remain in unprotected environment.	Potential short-term impacts • Short-term potential for worker contact with PCBs, ACM, RCRA, and radioactive wastes during processing and decontamination. Worker protection practices and procedures will minimize worker exposure to contaminated material during removal activities. • Short-term potential for migration of contamination off site via soil and sediment. Control measures will limit soil and sediment contamination migrating off site. • Short-term potential for spread of contamination via animal migration. Wildlife management provisions will restrict potential spread of contamination caused by animal migration. • Short-term potential for migration of contamination off site via air emissions. Controls, monitoring, and sampling will limit the spread of contamination due to air emissions.
		Implementability	
Ability to Construct & Operate Technologies	High	High • Standard S&M practices and erosion control provisions utilized.	Medium • Construction of required site improvements use generally accepted methods and practices. • Commercially available technologies for handling, segregating, sizing, surface decontamination, volume reduction, transportation, and dispositioning of materials. • Technologies for surface decontamination of scrap materials proven.
Availability and Reliability of Technologies	High	High • Standard S&M practices and erosion control provisions utilized.	Medium • Commercially available technologies for handling, segregating, sizing, surface decontamination, volume reduction, transportation and dispositioning of materials. • Technologies for surface decontamination of scrap materials proven.

Table 2. *Alternative comparisons* (continued)

Criteria	No Action Alternative	Continued Interim Action Alternative	Scrap Removal and Disposition with Nickel Ingot Storage Alternative
Availability of Treatment, Storage, and Disposal Services and Capacity	N/A	N/A	High • No treatment needed. • All disposal facilities available and capable of receiving most material. • Storage facilities available for storage of materials for which disposal facilities currently do not exist. • Structures for temporary storage of nickel ingots commercially available.
		Cost	
Capital Cost	$ 0	$0	$61,623,000
Operation & Maintenance Cost	$ 0	$9,230,000	$2,609,000
Total Cost (30-Year Life Cycle)	$ 0	$9,230,000	$64,232,000
Escalated Total Cost (30-Year Life Cycle)	$ 0	$12,916,000[a]	$67,264,000[a]

[a] Escalated at 2.1% per year over 30 years

5. PREFERRED REMOVAL ACTION ALTERNATIVE

Based on the comparative analysis, Alternative 3, Scrap Removal and Disposition with Nickel Ingot Storage is the preferred removal action alternative. In addition to effectiveness, implementability, and cost, the evaluation included consideration of the condition of the scrap metal, potential for decontamination of the scrap, and disposal options. Based on the evaluation, this alternative meets the RAOs for the removal action and is effective, can be implemented, and is the most cost-effective option. The removal action would be consistent with planned activities for the PGDP.

This alternative was selected because it would allow for evaluation of scrap for appropriate disposition (e.g., on-site and off-site disposal, recycle, etc.), nickel storage, and decontamination of select scrap materials. Scrap materials that cannot meet on-site disposal requirements and classified scrap would be disposed of at off-site facilities. In the event it is determined that some scrap is appropriate for recycle, it will be handled in accordance with DOE Orders and ARARs.

Based on process knowledge, scrap inventory, and limited contamination information, actions have been identified for the scrap material as part of the overall preferred alternative to assist in the preparation of the cost estimate. Although specific processing methods have been assumed in preparing the cost estimate, depending on the nature of the scrap, the actual processing methods and disposition employed could differ. Total 30-year life cycle costs for implementing the Scrap Removal and Disposition with Nickel Ingot Storage alternative are estimated at $64,232,000. From approval of the removal action work plan to completion of the removal action report, the action would require 46 months to complete. A detailed cost estimate and the major assumptions used to develop the cost estimate are presented in Appendix F.

6. REFERENCES

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APPENDIX A

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

R5004991

Location/Chemical/Action	Requirement	Prerequisite	Citation
Location Specific			
Endangered Species Act of 1973	Determine the presence of endangered or protected species under both Federal and State authorization, within the areas to be disturbed. Avoid, to the extent practicable, the disturbance of the areas within which the identified species reside. Take action to the extent practicable, to prevent unauthorized taking, possession, sale and transport of stated species.	Federal actions that involve potential impacts to endangered or protected species as defined by Federal or State regulations. – **applicable**	50 CFR 17
Migratory Bird Treaty Act of 1918	Take action, to the extent practicable, to prevent any unauthorized hunting, killing, capturing, attempted capture, delivery, sale, shipment, transport or receipt of any migratory birds included in this regulation or any part, nest or egg of any such bird.	Federal actions that involve potential impacts to migratory birds and mammals. – **applicable**	50 CFR 20 and 21
Presence of wetlands as defined in 10 CFR 1022.4(v)	Avoid, to the extent possible, the long- and short-term adverse effects associated with destruction, occupancy and modification of wetlands. Measures to mitigate adverse effects of action, include, but are not limited to: minimum grading requirements, runoff controls, design and construction constraints, and protection of ecology-sensitive areas as provided in 10 CFR 1022.12(a)(3).	Federal actions that involve potential impacts to, or take place within, wetlands – **applicable**	10 CFR 1022.3(a)
	Take action, to extent practicable, to minimize destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.		10 CFR 1022.3(b)
	Potential effects of any new construction in wetlands shall be evaluated. Identify, evaluate, and, as appropriate, implement alternative actions that may avoid or mitigate adverse impacts on wetlands.		10 CFR 1022.3(c) and (d)
	The location of any waste site or facility in a wetland is prohibited.	Siting of a waste site or facility within the Commonwealth of Kentucky – **applicable**	401 KAR 30:031

Location/Chemical/Action	Requirement	Prerequisite	Citation
Presence of floodplain as defined in 10 CFR 1022.4(i)	Avoid, to the extent possible, the long- and short-term adverse effects associated with occupancy and modification of floodplains. Measures to mitigate adverse effects of actions in a floodplain include, but are not limited to: minimum grading requirements, runoff controls, design and construction constraints, and protection of ecology-sensitive areas as provided in 10 CFR 1022.12(a)(3).	Federal actions that involve potential impacts to, or take place within, floodplains – **applicable**	10 CFR 1022.(3)(a)
	Potential effects of any action taken in a floodplain shall be evaluated. Identify, evaluate, and implement alternative actions that may avoid or mitigate adverse impacts on floodplains.		10 CFR 1022.3(c) and (d)
	Design or modify selected alternatives to minimize harm to or within floodplains and restore and preserve floodplain values.		10 CFR 1022.5(b)
	Construction activities in and along streams in the Commonwealth are prohibited unless the substantive requirements of 401 KAR 4:060 are met.	Construction activities impacting streams or floodplains – **applicable**	401 KAR 4:060
Chemical Specific			
Radionuclide emissions	Emissions from DOE facilities must not cause members of the public to receive, in any year, an effective dose equivalent in excess of 10 mrem/year.	Radionuclide emissions from a DOE facility – **applicable**	40 CFR 61.92
Releases of radionuclides into the environment	Exposure to individual members of the public from radiation shall not exceed a total EDE of 0.1 rem/year (100 mrem/year), exclusive of the dose contributions from background radiation, any medical administration the individual has received, or voluntary participation in medical/research programs.	Radionuclide releases at NRC – licensed facility – **relevant and appropriate**	10 CFR 20.1301(a)
Action Specific			
Management of PCB Items	Must dispose of in accordance with 40 CFR 761.60(b) or decontaminate in accordance with 40 CFR 761.79.	Removal from use of a PCB Item containing intact, nonleaking PCB Article – **applicable**	40 CFR 761.50(b)(2)

Location/Chemical/Action	Requirement	Prerequisite	Citation
	Must dispose of as bulk product waste in accordance with 40 CFR 761.62(a) or (c).	Removal from use of a PCB Item where PCB Article is no longer intact and nonleaking – **applicable**	40 CFR 761.50(b)(2)
Management of PCB/radioactive waste	Any person storing such waste <u>></u>50 ppm PCBs must do so taking into account both its PCB concentration and radioactive properties, except as provided in Section 761.65(a)(1), (b)(1)(ii), and (c)(6)(I).	Generation of PCB/radioactive waste for a disposal – **applicable**	40 CFR 761.50(b)(7)(i)
	Any person disposing of such waste must do so taking into account both its PCB concentration and its radioactive properties.		40 CFR 761.50(b)(7)(ii)
Generation of PCB waste (e.g., contaminated PPE, equipment)	Any person storing or disposing of PCB waste must do so in accordance with 40 CFR 761, Subpart D.	Generation of waste containing PCBs at concentrations ≥ 50 ppm – **applicable**	40 CFR 761.50(a)
Management of PCB waste	Any person storing or disposing of PCB waste must do so in accordance with 40 CFR 761/ Subpart D.	Generation of waste containing PCBs at concentrations ≥50 ppm – **applicable**	40 CFR 5(a)
	Any person cleaning up and disposing of PCBs shall do so based on the concentration at which per compliance to regulation.	Generation of PCB remediation waste as defined in 40 CFR 761.3 – **applicable**	40 CFR 761.61
	If after taking into account only the PCB properties in the waste, the waste meets the requirements for disposal in a facility, permitted, licensed, or registered by a state as a municipal or nonmunicipal nonhazardous waste landfill, e.g., PCB bulk product waste under 40 CFR 761.62(b)(1), then the person may dispose of such waste without regard to the PCBs, based on its radioactive properties alone in accordance with applicable requirements.		
Temporary storage of PCB waste (e.g., PPE, rags) in a container(s)	Container(s) shall be marked as illustrated in 40 CFR 761.45(a).	Storage of PCBs and PCB Items at concentrations ≥ 50 ppm for disposal – **applicable**	40 CFR 761.40(a)(1)
	Storage area must be properly marked as required by 40 CFR 761.40 (a) (10).		40 CFR 761.65(c)(3)

R5004991

Location/Chemical/Action	Requirement	Prerequisite	Citation
	Any leaking PCB Items and their contents shall be transferred immediately to a properly marked non-leaking container(s).		40 CFR 761.65(c)(5)
	Container(s) shall be in accordance with requirements set forth in DOT HMR at 49 CFR 171-180.		40 CFR 761.65(c)(6)
Storage of PCB waste and/or PCB/radioactive waste in a RCRA-regulated container storage area	Does not have to meet storage unit requirements in 40 CFR 761.65(b)(1) provided unit: • is permitted by EPA under RCRA §3004, or • qualifies for interim status under RCRA §3005; or • is permitted by an authorized state under RCRA §3006 and, • PCB spills cleaned up in accordance with Subpart G of 40 CFR 761.	Storage of PCBs and PCB Items designated for disposal – **applicable**	40 CFR 761.65(c)(6) 40 CFR 761.65(b)(2)(I) 40 CFR 761.65(b)(2)(ii) 40 CFR 761.65(b)(2)(iii) 40 CFR 761.65(c)(1)(iv)
Storage of PCB/radioactive waste in containers	For liquid wastes, containers must be nonleaking.	Storage of PCB/radioactive waste in containers other than those meeting DOT HMR performance standards – **applicable**	40 CFR 761.65(c)(6)(i)(A)
	For non-liquid wastes, containers must be designed to prevent buildup of liquids if such containers are stored in an area meeting the containment requirements of 40 CFR 761.65(b)(1)(ii); and		40 CFR 761.65(c)(6)(i)(B)
	For both liquid and non-liquid wastes, containers must meet all regulations and requirements pertaining to nuclear criticality safety.		40 CFR 761.65(c)(6)(i)(C)
Decontamination of PCB non-porous surface (e.g., scrap metal)	For unrestricted use, meet standard of: • ≤10 μg/100 cm^2 as measured by a standard wipe test; (40 CFR 761.123) at locations selected in accordance with 40 CFR 761.300 et seq.	Non-porous surfaces previously in contact with liquid PCBs, where no free-flowing liquids are present – **applicable**	40 CFR 761.79(b)(3)(i)(A)
	For disposal in a smelter operating in accordance with 40 CFR 761.72(b), meet standard of: • <100 μg/100 cm^2 as measured by a standard wipe test under 40 CFR 761.123) at locations selected in accordance with 40 CFR 761.300 et seq.	Non-porous surfaces previously in contact with liquid PCBs at any concentration, where no free-flowing liquids are present – **applicable**	40 CFR 761.79(b)(3)(ii)(A)

40

R5004991

Location/Chemical/Action	Requirement	Prerequisite	Citation
	• clean to regulatory standards. Verify compliance by visually inspecting all cleaned areas.	Non-porous surfaces in contact with non-liquid PCBs (including non-porous surfaces covered with a porous surface, e.g., paint or coating on metal – **applicable**	40 CFR 761.79(b)(3)(i)(B) 40 CFR 761.79(b)(3)(ii)(B)
Clean closure of TSCA storage facility	A TSCA/RCRA storage facility closed under RCRA is exempt from the TSCA closure requirements of 40 CFR 761.65(e).	Closure of TSCA/RCRA storage facility – **applicable**	40 CFR 761.65(e)(3)
Decontamination of PCB contaminated equipment	May decontaminate (in lieu of disposal) by: • Swabbing surfaces that have contacted PCBs with a solvent; or • A double wash/rinse as defined in 40 CFR 761.360-378, or • Another applicable decontamination procedure under 40 CFR 761.79	Equipment contaminated by PCBs – **applicable**	40 CFR 761.79(c)(2)
Disposal of PCB liquids or items	PCB liquids must be disposed of in one of the following manners: • In an incinerator operating in compliance with 40 CFR 761.70; • In a high-efficiency boiler (this method of disposal is available only for mineral oil dielectric fluid and other liquids containing PCBs > 500 ppm); or • In a chemical waste landfill operating in compliance with 40 CFR 761.75.	Disposal of PCB liquids containing PCBs ≥ 50 ppm – **applicable**	40 CFR 761.60
	PCB small capacitors may be disposed of in a municipal waste landfill.	PCB small capacitors – **applicable**	40 CFR 761.60(b)(2)(iii)
Disposal of PCB cleanup wastes (PPE or cleaning materials contaminated with PCBs)	Shall dispose of the waste in a facility permitted, licensed, or registered by a state to manage municipal solid waste or non-municipal nonhazardous waste; a RCRA Subtitle C landfill permitted to accept PCB waste, or a PCB disposal facility approved under the TSCA regulations; or decontaminate in accordance with 40 CFR 761.79(b) or (c).	Generation of non-liquid PCBs at any concentration during and from the cleaning of PCB remediation waste – **applicable**	40 CFR 761.61(a)(5)(v)(A)
Performance-based disposal of PCB bulk product waste	May dispose of by one of the following: • in an incinerator approved under 40 CFR 761.70; • in a chemical waste landfill approved under 40 CFR 761.75;	Disposal of PCB bulk product waste as defined in 40 CFR 761.3 – **applicable**	40 CFR 761.62(a) 40 CFR 761.62(a)(1) 40 CFR 761.62(a)(2)

41

Location/Chemical/Action	Requirement	Prerequisite	Citation
	• in a hazardous waste landfill permitted by EPA under §3004 of RCRA or by authorized state under §3006 of RCRA;		40 CFR 761.62(a)(3)
	• under alternate disposal approved under 40 CFR 761.60(e);		40 CFR 761.62(a)(4)
	• in accordance with decontamination provisions of 40 CFR 761.79; or		40 CFR 761.62(a)(5)
	• in accordance with thermal decontamination provisions of 40 CFR 761.79(c)(6) for metal surfaces in contact with PCBs.		40 CFR 761.62(a)(6)
Risk-based disposal of PCB bulk product waste	May dispose of in a manner other than prescribed in 40 CFR 761.62(a) or (b) if receive approval in writing from EPA and the method (based on technical, environmental or waste specific characteristics) will not pose an unreasonable risk of injury to human health or the environment.	Disposal of PCB bulk product waste – **applicable**	40 CFR 761.62(c)
Transportation of PCBs offsite	Prepare, use, and maintain manifest and manifest records in accordance with 40 CFR 761.207-209.	Transportation of PCB-contaminated waste ≥ 50 ppm for commercial off-site storage or disposal – **applicable**	40 CFR 761.207-209
	The waste must meet packaging, labeling, marking, placarding, manifest and pretransport requirements.		49 CFR 172, 173, 175, 178 and 179
	Carrier must be licensed and obtain the appropriate permits for the transportation of each radioactive or hazardous waste or materials.		902 KAR 100.070 10 CFR 71.5 DOE Order 460.1 (TBC)
Characterization of solid waste (e.g., contaminated PPE, equipment, wastewater)	Must determine if that waste is hazardous waste or if waste is excluded under 40 CFR 261.4; and	Generation of solid waste as defined in 40 CFR 261.2 – **applicable**	40 CFR 262.11(a)
	Must determine if waste is listed under 40 CFR Part 261; or		40 CFR 262.11(b)
	Must characterize waste by using prescribed testing methods or applying generator knowledge based on information regarding material or processes used. If waste is determined to be hazardous, it must be managed in accordance with 40 CFR 261-268.		40 CFR 262.11(c) and (d)

Location/Chemical/Action	Requirement	Prerequisite	Citation
Release of scrap metal	Before being released, property shall be surveyed to determine whether both removable and total surface contamination (including contamination present on or under any coating) is greater than the levels given in Figure IV-1 of the Order and that the contamination has been subjected to the ALARA process.	Residual radioactive material on equipment structures for unrestricted use – **(TBC)**	DOE Order 5400.5 (IV)(4)(d)
	Potentially surface-contaminated metals may be released to the public without restrictions on use if both removable and total surface contamination meet levels specified in Figure IV of DOE Order 5400.5.	Radionuclide-contaminated scrap materials and equipment intended for recycle or reuse – **(TBC)**	DOE Order 5400.5(II)(5)(c)
		Clearance of equipment and materials from nuclear facilities. – **(TBC)**	NUREG-1640, *Radiological Assessments of Clearance of Equipment and Materials From Nuclear Facilities*
		Radionuclide-contaminated scrap materials and equipment intended for recycle or reuse – **(TBC)**	*U.S. Environmental Protection Agency, Office of Radiation and Indoor Air "Evaluation for Recycling of Scrap Metals From Nuclear Faciliti*es, March 1997.
		Clearance of equipment and materials from nuclear facilities. – **(TBC)**	IAEA-TECDOC-855, *International Atomic Energy Agency, Clearance Levels for Radionuclides in Solid Materials*, , January 1996
Characterization of hazardous waste (e.g., contaminated PPE, equipment, wastewater, soil)	Must obtain a detailed chemical and physical analysis of a representative sample of the waste(s) which at a minimum contains all the information which must be known to treat, store, or dispose of the waste in accordance with 40 CFR 264 and 268.	Generation of RCRA hazardous waste for storage, treatment or disposal – **applicable**	40 CFR 262.13(a)(1)
	Must determine if the waste is restricted from land disposal under 40 CFR 268 et seq. by testing in accordance with prescribed methods or use of generator knowledge of waste.		40 CFR 268.7

Location/Chemical/Action	Requirement	Prerequisite	Citation
Generation of hazardous waste	Must obtain a detailed chemical and physical analysis of a representative sample of the waste(s) which at a minimum contains all the information which must be known to treat, store, or dispose of the waste in accordance with 40 CFR 264 and 268.	Generation of RCRA hazardous waste for storage, treatment, or disposal – **applicable**	40 CFR 264.13(a)(1) KAR 32:030
Accumulation of hazardous waste onsite	Hazardous waste may be stored onsite provided that it is stored in containers or tanks that are managed in accordance with the minimum standards specified in 40 CFR Part 265, such as labeling and marking (including "hazardous waste" label).	Accumulation of RCRA hazardous waste onsite – **applicable**	40 CFR 262.34(a) 401 KAR 32:030
Storage of hazardous waste in containers	Ensure that containers of hazardous waste are • Maintained in good condition; • Compatible with hazardous waste to be stored; • Closed during storage (except to add or remove waste); • Opened, handled, or stored in a manner that will not cause containers to rupture or leak.	Storage of RCRA hazardous waste (listed or characteristic) – **applicable**	40 CFR 264.171 40 CFR 264.172 40 CFR 264.173(a) and (b) 401 KAR 34:180(2) 401 KAR 34:180(3) 401 KAR 34:180(4)
	Inspect container storage areas weekly for deterioration.		40 CFR 264.174 401 KAR 34:180(5)
Management of RCRA hazardous waste in container storage area	Place containers on a sloped, crack-free base and protect from contact with accumulated liquid; provide containment system with a capacity of 10% of the volume of containers; remove spilled or leaked waste in a timely manner to prevent overflow to the containment system; prevent run-on into the containment system.		40 CFR 264.175(b) 401 KAR 34:180(6(2))
	Storage area must be sloped to allow drainage of liquid resulting from precipitation; containers should be elevated or otherwise protected from accumulated liquid.	Containers of hazardous waste that do not contain free liquids – **applicable**	40 CFR 264.175(c) 401 KAR 34:180(6(3))
	Containers of ignitable or reactive waste must be stored at least 15.24 m (50 ft) from the facility's property line.	Storage of ignitable or reactive wastes hazardous waste – **applicable**	40 CFR 264.176 401 KAR 34:180(7)
	Separate incompatible materials by a dike or other barrier.	Storage of incompatible hazardous waste – **applicable**	40 CFR 264.177 401 KAR 34:180(8)

Location/Chemical/Action	Requirement	Prerequisite	Citation
Solid waste disposal	Debris that is no longer contaminated with hazardous waste is no longer subject to Subtitle C regulation. *Note:* May be land disposed in a Subtitle D facility without further treatment.	Hazardous waste debris – **applicable**	40 CFR 261.3(f)(2)
Disposal of nonhazardous solid waste	May be disposed in a permitted landfill if it meets the permit requirements and their waste acceptance criteria; a "special waste approval" may be necessary.	Nonhazardous solid waste – **applicable**	40 CFR 258 401 KAR 47
Land disposal of restricted RCRA waste		Placement of RCRA-restricted hazardous waste – **applicable**	40 CFR 268.40(a) 40 CFR 268.40 401 KAR 37:010 401 KAR 37:030
Treatment of debris contaminated with RCRA hazardous waste	Must be treated before land disposal using extraction, destruction, or immobilization technologies or treated to meet the waste-specific treatment standard for the wastes contaminating the debris.	Contaminated with RCRA listed or characteristic waste – **applicable**	40 CFR 268.45 (a)(d)
	Residues from the treatment of hazardous debris must be separated from the debris. Such residues are subject to the waste-specific treatment standards for the waste contaminating the debris.		40 CFR 268.45 (d)
Disposal of treated debris	Debris treated by one of the specified extraction or destruction technologies meets the requirements for a clean debris surface, no longer exhibits a characteristic, meets the LDR treatment standards, and is no longer subject to the LDR. Such debris may be disposed of at a sanitary landfill, recycled, or reused.	Potentially clean debris that has been treated – **applicable**	40 CFR 268.45(c)
	Debris treated by immobilization must be disposed of in a Subtitle C facility.		
Disposal of nonhazardous solid waste	May be disposed in a permitted landfill if it meets the permit requirements and their waste acceptance criteria; a "special waste approval" may be necessary.	Nonhazardous solid waste – **applicable**	40 CFR 258 401 KAR 47
Transportation of hazardous waste	Waste must be packaged, labeled, and transported in accordance with DOT hazardous materials regulations under 49 CFR Parts 170-179. Waste must be manifested as specified.	Off-site transportation of RCRA hazardous waste – **applicable**	40 CFR 262.10(h) 401 KAR 32

Location/Chemical/Action	Requirement	Prerequisite	Citation
Off-site shipment of non-radioactive waste	Hazardous or toxic waste originating from the PGDP that is determined to be non-radioactive by virtue of process knowledge and surface smear surveys may be shipped offsite.	Off-site shipment of a non-radioactive hazardous or toxic waste other than bulk materials.	DOE, 1995 (TBC)
Characterization of low-level waste	Low-level waste must be characterized with sufficient accuracy to permit proper segregation, treatment, storage, and disposal.	Generation of radioactive waste – **(TBC)**	DOE Order 435.1
	Waste characterization data must be recorded on a waste manifest and must include the following: • Physical and chemical characteristics of the waste; • Volume of the waste; • Weight of the waste; • Major radionuclides and their concentrations; and • Packaging data, package weight, and external volume.	Generation of radioactive waste – **(TBC)**	DOE Order 435.1
Radioactive waste minimization	The generation, treatment, storage, transportation, and/or disposal of radioactive wastes will be accomplished in a manner that minimizes the generation of such wastes.	Generation and management of radioactive waste – **(TBC)**	DOE Order 435.1
LLW storage	Ensure that radioactive releases to surface wastes, groundwater, soil, plants, and animals, do not exceed an EDE of 25 mrem/year to any member of the public. Reasonable efforts shall be made to maintain releases of radioactivity in effluents to the general environment ALARA.	Management of LLW at a DOE facility – **(TBC)**	DOE Order 435.1
LLW disposal	Must meet waste acceptance criteria for the receiving facility.	Disposal of LLW – **(TBC)**	DOE Order 435.1
	Site-specific ALARA analysis of bulk materials with volume radiological contamination required to ensure that waste acceptance criteria for the receiving disposal facility are met.	**(TBC)**	DOE Order 5400.5
	LLW must be disposed of on the site where it is generated, if possible. If not possible, disposal must occur at another DOE facility.	**(TBC)**	DOE Order 435.1
Off-site transportation of LLW	Off-site disposal of LLW to a commercial facility requires an exemption from the on-site disposal requirements of DOE Order 435.1; requests for exemption must be approved by DOE-ORO.	**(TBC)**	DOE Order 435.1

46

Location/Chemical/Action	Requirement	Prerequisite	Citation
	Radioactively contaminated waste must not be shipped to a commercial treatment or disposal facility that is not licensed by the NRC or an agreement state.	Any off-site shipment of a potentially radioactive-contaminated waste that is also a hazardous or toxic waste – **(TBC)**	DOE, 1997 DOE Order 5400.5
Transportation of LLW or mixed waste to a licensed off-site disposal facility	The waste must meet packaging, labeling, marking, placarding, manifest and pretransport requirements.	Transportation of radioactive waste offsite – **applicable**	49 CFR 172, 173, 175, 178 and 179 902 KAR 100.070
	Carrier must be licensed and obtain the appropriate permits for the transportation of each radioactive or hazardous waste or materials.	Transportation of radioactive waste offsite –**relevant and appropriate**	10 CFR 71.5
	Packaging requirements based on the maximum activity of radioactive material in a package.		49 CFR 173.431; 49 CFR 173.433; 49 CFR 173.435; 49 CFR 173.411 DOE Order 460.1(TBC)
Asbestos air emissions from demolition operations	Must not discharge visible emissions to the outside air. Rather than meet the no visible emission requirement, must adequately wet asbestos-containing waste material, process asbestos-containing waste material into nonfriable forms, or employ an alternative emission control and waste treatment method that has received EPA approval.	Collection, processing (including incineration), packaging, or transporting of asbestos-containing waste materials – **applicable**	40 CFR 61.150(a)(b) 40 CFR 61.145
Disposal of asbestos-containing waste material	All asbestos-containing waste material shall be deposited as soon as practicable at an approved waste disposal site; does not apply to Category 1 nonfriable asbestos-containing material that is not RCRA.	Waste material containing asbestos – **applicable**	40 CFR 61.150(b)
Transportation of asbestos to a licensed off-site disposal facility	The waste must meet packaging, labeling, marking, placarding, manifest and pretransport requirements.	Transportation of asbestos off-site – **applicable**	49 CFR 172, 173, 175, 178 and 179 902 KAR 100.070 10 CFR 71.5 DOE Order 460.1 (TBC)

47

Location/Chemical/Action	Requirement	Prerequisite	Citation
Fugitive air emissions	Reasonable precaution must be taken to prevent particulate matter from becoming airborne and ensure that no visible dust is emitted beyond the property boundary line. Such precautions may include the following: • Use of water or chemicals to control dust from construction activities; • Placement of asphalt, oil, water, or suitable chemicals on roads and material stockpiles to control dust; • Ensure that all open-bodied trucks are covered if any materials could become airborne; • Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials, or the use of water sprays or other measures to suppress the dust emissions during handling; • Employ adequate containment methods during sandblasting or other similar operations; and • Prompt removal of earth or other material from a paved street when earth or other material has been deposited by trucks, earth-moving equipment, or erosion by water.	Handling, processing, construction, road-grading, land-clearing activities, and any other activity that could produce fugitive dust emissions – **applicable**	401 KAR 63:010(3) 401 KAR 63:010(4(1))
Storm-water discharge	Best management practices (BMPs) and sediment and erosion controls must be used to minimize storm-water discharges.	Applicability related to < 5 acres of construction site – **relevant and appropriate**	40 CFR Part 122 401 KAR 5:080 (1(2)(d))

APPENDIX B

STREAMLINED RISK ANALYSIS

B.1. STREAMLINED RISK ANALYSIS

The streamlined risk analysis performed on the removal of scrap metal focused on transportation risk. The following section discusses the risk analysis for the preferred alternative (i.e., Alternative 3, Scrap Removal and Disposition with Nickel Ingot Storage.)

B.1.1 Off-site Disposal (Transportation Risk Analysis)

The Transportation Risk Analysis was performed focusing primarily on risk to the public. Table B.1 shows the shipment assumptions for the preferred alternative. It is assumed that exposure to all remediation workers will be closely monitored to ensure that exposure does not exceed permissible levels. The transportation analysis was performed using the destinations of Clive, UT (Envirocare) and Mercury, NV (NTS) (the locations were identified as representative destinations for purposes of this transportation risk analysis). It was assumed that the scrap metal would be transported by rail from PGDP to Clive, UT (Envirocare). Furthermore, since direct rail service to NTS is not available, it was also assumed that the scrap metal being shipped to NTS will be transported by rail from PGDP to Moab, UT and by truck from Moab, UT to Mercury, NV (NTS). Moab, UT, approximately 35 miles from Cisco, UT (actual rail transfer station) was selected as the rail transfer station for the routing model since Cisco, UT, as a destination, is not included in the routing model. Although, Cisco, UT was not used as a rail transfer station in the routing model, it is expected that using a nearby alternate rail transfer station will not have any affect in the risk analysis. Two different areas were identified that cause risk to the public, as follows:

- Vehicle-Related Transportation Risk - Vehicle-related transportation risk is concerned with the possibility of an accident occurring during a waste shipment. These impacts are independent of the type of material that is being shipped. State-specific accident and fatality data were used to estimate the expected impacts.

- Cargo-Related Transportation Risk - Cargo-related transportation risk is concerned with exposure to the shipment material. Three different types of public receptors were identified and evaluated for exposure using the RADTRAN 4 computer code (Neuhauser and Kanipe 1994): people who live along the shipment route (Off Link), people who share the transportation corridor while riding in other vehicles (On Link), and people who are present at the required shipment stops.

Table B.1. Shipment assumptions used for the preferred alternative

Origin	Destination	Material	Mode of transport	Type of Container	Size of container	Quantity (tons)	No. of containers/ vehicle	No. of containers/ shipment	Number of shipments
PGDP	Clive, UT (Envirocare)	Scrap	Rail	Intermodal	20 x 8 x 8 ft	2,010	6	30	4
PGDP	Clive, UT (Envirocare)	Regulated scrap	Rail	B-25 boxes	6 x 4 x 4 ft	45	10	50	1
PGDP	Moab, UT[a]	Scrap	Rail	Intermodal	20 x 8 x 8 ft	13,272	6	30	25
PGDP	Moab, UT[a]	Classified scrap	Rail	Sealand	19'5" x 7'9-5/8" x 7'8-1/8"	15,887	6	30	23
Moab, UT	Mercury, NV (NTS)	Scrap	Truck	Intermodal	20 x 8 x 8 ft	13,272	2	2	369
Moab, UT	Mercury, NV (NTS)	Classified scrap	Truck	Sealand	19'5" x 7'9-5/8" x 7'8-1/8"	15,887	2	2	331

[a] It is assumed that containers will be transported by truck from Moab, UT, to Mercury, NV, due to non-availability of rail service to Mercury, NV (NTS).

Routing

Rail routes were determined by the INTERLINE 5.0 computer model (Johnson et al. 1993a). The INTERLINE computer model is designed to simulate routing on the U.S. rail system. The INTERLINE database was originally based on data from the Federal Railroad Administration and reflected the U.S. railroad system in 1974. The database has been expanded and modified over the past two decades. The code is updated periodically to reflect current track conditions and has been compared with reported mileages and observations of commercial rail firms.

The INTERLINE model used the shortest route algorithm that finds the path of minimum impedance within an individual subnetwork. A separate method is used to find paths along the subnetworks. The routes chosen for this study used the standard assumptions in the INTERLINE model to simulate the process of selection that railroads would use to direct shipments of radioactive waste. For sites that do not have direct rail access, the rail site nearest the waste shipment endpoint was used for routing.

The truck route was determined using the HIGHWAY 3.1 computer code (Johnson et al. 1993b). The HIGHWAY model is a computerized road atlas that details more than 386,000 km (240,000 miles) of interstate and other highways. The user can specify the routing criteria to constrain the route selection. The HIGHWAY model calculates the total route length and the distances traveled through rural, suburban, and urban population zones. Population densities along the route are determined by 1990 census data.

The HIGHWAY model contains a HM-164 option which was used for the route generated in this analysis. The HM-164 option specifies a route that would comply with DOT regulations for quantities of radioactive material that require controlled highway routes. The HIGHWAY model code was used to generate a representative route for the purposes of analysis only; actual route for shipments have not been determined. The distance between Moab, UT, and Mercury, NV (NTS), is estimated to be 516 miles by road.

Analysis

Vehicle-Related Transportation Risk - Impacts of rail and truck accidents associated with transporting the material to its destination were analyzed. These impacts are not related to the radioactive material or hazardous chemicals being transported and would be the same as the impacts from the transportation of nonhazardous material. Impacts were calculated as the number of accidents and fatalities that would be expected due to additional rail and truck traffic along the proposed routes. Accidents and fatalities were calculated on a per-shipment basis and were then totaled for all shipments over the transportation period. Calculations were based on data presented in *State-Level Accident Rates of Surface Freight Transportation* (Saricks and Tompkins 1999).

Accident and fatality rates for rail travel in rural, urban, and suburban population areas in each state are assumed to be the same. Accident rates for trucks used in this assessment were computed using data from all shipments regardless of cargo. Saricks and Tompkins (1999) point out that shippers and carriers of radioactive material have a higher than average awareness of transportation impacts and prepare for such shipments accordingly, thereby reducing their accident rate. These effects were not considered and accident rates were assumed to be identical to normal cargo. Separate accident and fatality rates for travel in interstate and primary highway population areas in each state were used. The accident and fatality impacts depend on state-specific accident and fatality rates for the two categories of population areas.

Impacts were calculated on a per-shipment basis and then multiplied by the total required number of shipments to determine the total expected impacts (Table B.2). Impacts were calculated assuming one-way transportation and do not include round-trip calculations for return of rail or containers as it is assumed that the empty containers from Clive, UT and Mercury, NV (NTS) will not be transported back to PGDP.

Table B.2. Vehicle-related transportation impacts

Origin	Destination	Mode of transport	Type of container	Distance (miles)	Shipments	Expected accidents	Expected fatalities
PGDP	Clive, UT (Envirocare)	Rail	Intermodal	1808.5	4	6.67E-4	1.79E-4
PGDP	Clive, UT (Envirocare)	Rail	B-25 boxes	1808.5	1	1.67E-4	4.48E-5
PGDP	Moab, UT[a]	Rail	Intermodal	1546.5	25	3.55E-3	8.53E-4
PGDP	Moab, UT[a]	Rail	Sealand	1546.5	23	3.27E-3	7.85E-4
Moab, UT	Mercury, NV (NTS)	Truck	Intermodal	516	369	9.21E-2	3.76E-3
Moab, UT	Mercury, NV (NTS)	Truck	Sealand	516	331	8.27E-2	3.37E-3

[a] It is assumed that containers will be transported by truck from Moab, UT, to Mercury, NV, due to non-availability of rail service to Mercury, NV (NTS).

Cargo-Related Transportation Risk - The RADTRAN 4 model (Neuhauser and Kanipe 1994) was used to estimate the radiological impacts of accident-free transportation to public receptors. Three types of receptors were analyzed using the RADTRAN 4 code. The receptor types were:

- Along Route (Off Link): Exposure to individuals who reside adjacent to routes of travel.

- Sharing Route (On Link): Exposure to individuals sharing the right of way (i.e., driving along the same road).

- Stops: Exposure to individuals while shipments are at rest stops.

Among the more sensitive RADTRAN input parameters is the Transport Index (TI). The TI represents the radiation dose at 1 m away from the surface of the shipping package. The maximum radiation dose permissible is 10 mrem/h at 2 m. This regulatory limit was used to determine the TI (i.e., the maximum allowable dose at 1 m). This calculation is dependent on shipping configuration and dimensions of the individual packages.

Table B.3 presents the TI calculated for each mode of transport, destination, shipping configuration, and dimension. During performance of work, the actual measured radiation dose will be used to comply with the regulations.

Table B.3. Transport index

Origin	Destination	Mode of transport	Type of container	Size of container	No. of containers/ rail car (or truck)	No of rail cars/ trip	Packages/ shipment	Transport index
PGDP	Clive, UT (Envirocare)	Rail	Intermodal	20 x 8 x 8 ft	6	5	30	0.43
PGDP	Clive, UT (Envirocare)	Rail	B-25 boxes	6 x 4 x 4 ft	10	5	50	0.29
PGDP	Moab, UT[a]	Rail	Intermodal	20 x 8 x 8 ft	6	5	30	0.43
PGDP	Moab, UT[a]	Rail	Sealand	19'5" x 7'9-5/8" x 7'8-1/8"	6	5	30	0.43
Moab, UT	Mercury, NV (NTS)	Truck	Intermodal	20 x 8 x 8 ft	2	-	2	6.40
Moab, UT	Mercury, NV (NTS)	Truck	Sealand	19'5" x 7'9-5/8" x 7'8-1/8"	2	-	2	6.42

[a] It is assumed that containers will be transported by truck from Moab, UT, to Mercury, NV, due to non-availability of rail service to Mercury, NV (NTS).

Required rail route-specific inputs such as the number of miles traveled in each of the population zones (urban, suburban, and rural) and the population adjacent to shipping routes were determined using the INTERLINE 5.0 model described in the Routing section. The rail speed was assumed to be 64, 40, and 24 km/h (40, 25, and 15 mph) in rural, suburban, and urban zones, respectively. These speeds probably underestimate the speed of the rail car in each of the population zones, but this results in a conservative estimation of exposure and also accounts for the possibility of traffic slowdowns. It is further assumed that vehicle density for rural, suburban, and urban areas is 1, 5, and 5 vehicles per hour, respectively.

All rail shipments were assumed to have 0.033 h of stopping time for every kilometer traveled. It was assumed that 100 people were present at each stop and they were an average of 20 m from the waste shipments.

Required truck route-specific inputs such as the number of miles traveled in each of the population zones (urban, suburban, and rural) and the population adjacent to shipping routes were determined using the HIGHWAY model. It was assumed that two individuals were present in each passing car and the one-way traffic count for rural, suburban, and urban population zones was 470, 780, and 2800, respectively. The truck speed was assumed to be 88, 40, and 24 kph (55, 25, and 15 mph) in rural, suburban, and urban zones, respectively. These speeds probably underestimate the speed of the truck in each of the population zones, but this results in a conservative estimation of exposure and also accounts for the possibility of traffic slowdowns.

All truck shipments were assumed to have 0.011 h of stopping time for every kilometer traveled. This rate also accounts for overnight stopping. It was assumed that 50 people were present at each of the stops and they were an average of 20 m from the waste shipments.

The impacts estimated from RADTRAN are in units of person-rems. These units can be converted into latent cancer fatalities (LCFs) using the conversion factor of 5×10^{-4} LCFs per person-rem (ICRP 1991). The LCF is the additional increase in the total number of cancer fatalities due to the radiation dose. Cargo-related impacts in terms of both person-rems and LCFs for transportation by rail and truck are presented in Table B.4.

Table B.4. Cargo-related transportation impacts

				Residing along route		Sharing route		Rest stops		Totals	
Origin	**Destination**	**Mode of transport**	**Type of container**	**Person-rems**	**LCFs**	**Person-rems**	**LCFs**	**Person-rems**	**LCFs**	**Person-rems**	**LCFs**
PGDP	Clive, UT (Envirocare)	Rail	Intermodal	3.3E-02	1.6E-05	2.4E-03	1.2E-06	4.8E-03	2.4E-06	4.0E-02	2.0E-05
PGDP	Clive, UT (Envirocare)	Rail	B-25 boxes	2.6E-03	1.3E-06	2.0E-04	9.8E-08	3.9E-04	1.9E-07	3.2E-03	1.6E-06
PGDP	Moab, UT[a]	Rail	Intermodal	1.6E-01	7.8E-05	1.2E-02	6.2E-06	2.2E-02	1.1E-05	1.9E-01	9.5E-05
PGDP	Moab, UT[a]	Rail	Sealand	1.4E-01	7.0E-05	1.1E-02	5.6E-06	2.0E-02	1.0E-05	1.7E-01	8.5E-05
Moab, UT	Mercury, NV (NTS)	Truck	Intermodal	3.3E-01	1.6E-04	4.4E+00	2.2E-03	6.9E+01	3.5E-02	7.4E+01	3.7E-02
Moab, UT	Mercury, NV (NTS)	Truck	Sealand	2.9E-01	1.4E-04	3.8E+00	1.9E-03	6.1E+01	3.0E-02	6.5E+01	3.2E-02

[a] It is assumed that containers will be transported by truck from Moab, UT, to Mercury, NV, due to non-availability of rail service to Mercury, NV (NTS).

Summary results

Tables B.5 and B.6 presents the summary of vehicle-related and cargo-related transportation impacts, respectively, for the off-site disposal of scrap metal.

The total vehicle-related fatalities is calculated to be 0.00898. The total cargo-related LCF is 0.0672 to the receptors considered. The LCF is less than one and is based on the maximum permissible radiation dose of 10 mrem/h at 2 m. It is expected that at 2 m no radiation above background would be detected due to the expected contamination levels of the materials being shipped. Therefore, the actual total LCFs due to material being shipped by the proposed removal action likely will only be a small fraction of the calculated total LCF.

R5004991

Table B.5. Summary of vehicle-related transportation impacts

Origin	Destination	Intermodals (rail)		Intermodals (truck)		Sealand (rail)		Sealand (truck)		B-25 Boxes (rail)		TOTAL
		Accidents	Fatalities	Accidents	Fatalities	Accidents	Fatalities	Accidents	Fatalities	Accidents	Fatalities	Fatalities
PGDP	Clive, UT (Envirocare)	6.67E-04	1.79E-04	-	-	-	-	-	-	1.67E-04	4.48E-05	2.24E-04
PGDP	Mercury, NV (NTS)[a]	3.55E-03	8.53E-04	9.21E-02	3.76E-03	3.27E-03	7.85E-04	8.27E-02	3.37E-03	-	-	8.77E-3
TOTAL		4.22E-03	1.03E-03	9.21E-02	3.76E-03	3.27E-03	7.85E-04	8.27E-02	3.37E-03	1.67E-04	4.48E-05	**8.99E-03**

[a] See Table B.2 for details. PGDP to Moab, UT, by rail and Moab, UT, to Mercury, NV (NTS), by truck.

55

Table B.5. Summary of cargo-related transportation impacts

Origin	Destination	Intermodals (rail)		Intermodals (truck)		Sealand (rail)		Sealand (truck)		B-25 Boxes (rail)		TOTAL	
		Person-rems	LCFs	Person-rems	LCFs	Person-rems	LCFs	Person-rems	LCFs	Person-rems	LCFs	Person-rems	LCFs
PGDP	Clive, UT (Envirocare)	4.02E-02	2.0E-05	-	-	-	-	-	-	3.2E-03	1.6E-06	4.34E-02	2.16E-05
PGDP	Mercury, NV (NTS)[a]	1.90E-01	9.5E-05	7.4E+01	3.7E-02	1.7E-01	8.5E-05	6.5E+01	3.2E-02	-	-	1.39E+02	6.92E-02
TOTAL		2.30E-1	1.15E-04	7.4E+01	3.7E-02	1.7E-01	8.5E-05	6.5E+01	3.2E-02	3.2E-03	1.6E-06	**1.39E+02**	**6.92E-02**

[a] See Table B.4 for details. PGDP to Moab, UT, by rail and Moab, UT, to Mercury, NV (NTS), by truck.

The significance of the impacts of cancer on the death rate is related in population statistics that indicate that cancer (malignant neoplasms including neoplasms of lymphatic and hematopoietic tissues) caused 23.3% of the deaths in the United States in 1997 (Hoyert, Kochanek, and Murphy 1999).

B.1.2 On-site Disposal and Storage

The cost estimate assumptions for the preferred alternative includes disposal of approximately 12,551 tons of scrap material at the PGDP Solid Waste C-746-U Landfill. Only scrap material that meets the landfill disposal criteria will be considered for disposal onsite. In addition, it was assumed that 8,500 contaminated nickel ingots (~9,700 tons) will be stored in a storage facility on site, and that 50 B-25 boxes containing classified mixed waste, classified RCRA waste, or PCB low level radioactive waste (~45 tons) will be stored at PGDP and managed in compliance with applicable regulations.

On-site transportation impacts due to disposal of scrap metal at the C-746-U Landfill and the storage of scrap metal at the storage facilities will be small as compared to the off-site transportation impacts. This is due to much shorter travel distance and lower population density within the PGDP facility.

B.1.3. Risk to Workers

The risk to workers under Alternatives 3 includes:

- Radiation exposure from the inhalation and ingestion of airborne contamination and particulates; and
- Dermal contact with, inhalation of, and ingestion of decontamination solutions.

Occupational exposures to workers are monitored through the use of personal dosimetry, health physics surveys, and bioassay programs as regulated by 10 CFR 835, "Occupational Radiation Protection." Personal protective equipment will be utilized to minimize exposures and to protect workers. The exposure associated with the recycling will be higher due to increased decontamination activities. However, activities associated with the removal action and the decontamination operations will comply with 10 CFR 835.

B.2. REFERENCES

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APPENDIX C

SCRAP METAL INVENTORY

Source: U.S. Department of Energy Scrap Metal Inventory Report for the Office of Technology Development, Office of Environmental Management, March 1995, DOE/HWP-167

R5004991

APPENDIX C. SCRAP METAL INVENTORY

Metal Scrap Inventory By Location (Al – Aluminum, Fe – Steel, SS – Stainless Steel, and Cu – Copper)

Location	Scrap Description	Material	P – Packaged N – Not packaged	C – Contaminated U - Uncontaminated	Number Units	Unit Weight (Tons)	Amount (Tons)	Comments
C-746-C, Contaminated Excess Metal Yards								
C-746-C	piles, drums, pipe, and mix	Al	N	C			1.5	pile 1 just south of drums
C-746-C	piles, drums, pipe and mix	Al	N	C			46	large pile—Al portion 1%
C-746-C	piles, drums, pipe, and mix	Cu	N	C			2	pile 1 south of drums
C-746-C	piles, drums, pipe, and mix	Fe	P	C	1212	0.05	60.6	55-gallon drums
C-746-C	piles, drums, pipe, and mix	Fe	P	C	1212	0.05	60.6	55-gallon drums
C-746-C	piles, drums, pipe, and mix	Fe	N	C			16.5	pile 1 south of drums
C-746-C	piles, drums, pipe, and mix	Fe	N	C			27.25	pile 2 south of pile 1
C-746-C	piles, drums, pipe, and mix	Fe	N	C			4,521	large pile—20% nickel-plated steel
C-746-C	piles, drums, pipe, and mix	SS	N	C			2	stainless steel pipe
TOTAL C-746-C							**4,737.45**	
C-746-C1 Contaminated Excess Metal Yards								
C-746-C1	piles, fins, compressor shells, ingots	Al	P	C	1620	0.65	1,053	Al ingots
C-746-C1	air handlers, piles, equipment, ingots	Al	N	C	150	0.05	7.5	bomb casings
C-746-C1	piles, fins, compressor shells, ingots	Al	N	C			11	cast ingots (different)
C-746-C1	piles, fins, compressor shells, ingots	Al	N	C			187	compressor shells
C-746-C1	piles, fins, compressor shells, ingots	Al	N	C			204	Al fins
C-746-C1	piles, fins, compressor shells, ingots	Al	N	C			260	Al lids

APPENDIX C (continued)

Location	Scrap Description	Material	P – Packaged N – Not packaged	C – Contaminated U - Uncontaminated	Number Units	Unit Weight (Tons)	Amount (Tons)	Comments
C-746-C1	air handlers, piles, equipment , ingots	Cu	N	C	8	1.2	9.6	Fairbank—Morse Pump Motors
C-746-C1	air handlers, piles equipment, ingots	Cu	N	C	24	0.5	12	Cu tubing from air handlers
C-746-C1	air handlers, piles, equipment, ingots	Fe	N	C			0.5	tub—50% stainless steel
C-746-C1	air handlers, piles, equipment, ingots	Fe	N	C	1	1.5	1.5	marvel saw
C-746-C1	air handlers, piles, equipment, ingots	Fe	N	C			2	iron mix
C-746-C1	air handlers, piles, equipment, ingots	Fe	N	C			8.5	iron pipe
C-746-C1	air handlers, piles, equipment, ingots	Fe	N	C	8	4.8	38.4	Fairbanks—Morse Pump Motors
C-746-C1	air handlers, piles, equipment, ingots	Fe	N	C	24	2	48	iron sheet—air handlers
C-746-C1	piles, fins, compressor shells, ingots	Fe	N	C			1.5	grating and equipment
C-746-C1	piles, fins, compressor shells, ingots	Fe	N	C			2	iron tanks
C-746-C1	piles, fins, compressor shells, ingots	Fe	N	C			651	nickel-plated/pipe
C-746-C1	piles, fins, compressor shells, ingots	Fe	N	C			879.9	pile—mixed
C-746-C1	air handlers, piles, equipment, ingots	SS	N	C			0.5	plating acid tank
C-746-C1	air handlers, piles, equipment, ingots	SS	N	C			0.5	tub 50% iron
C-746-C1	air handlers, piles, equipment, ingots	SS	N	C			14	stainless steel tanks and equipment

R5004991

APPENDIX C (continued)

Location	Scrap Description	Material	P – Packaged N - Not packaged	C – Contaminated U - Uncontaminated	Number Units	Unit Weight (Tons)	Amount (Tons)	Comments
C-746-C1	piles, fins, compressor shells, ingots	SS	N	C			1.5	stainless steel pipe
TOTAL C-746-C1							**3,393.9**	
C-746-D, Classified Excess Metal Yard								
C-746-D	classified	Fe	N	C			14,560	
TOTAL C-746-D							**14,560**	
C-746-E, Contaminated Excess Metal Yards								
C-746-E	pipe, mix and rings	Al	P	C	192	0.02	3.8	Al shavings in 55-gallon drums
C-746-E	pipe, mix, and rings	Al	N	C			0.25	500 # Al
C-746-E	pipe, mix, and rings	Fe	N	C	192	0.2	38.5	iron shavings in 55-gallon drums
C-746-E	pipes and plate	Fe	N	C	7	2.5	17.5	end pieces
C-746-E	pipes and plate	Fe	N	C	5	4.3	21.5	converter shells
C-746-E	pipes and plate	Fe	N	C			60.3	all nickel plated—small pile
C-746-E	pipes and plate	Fe	N	C			11,900	50% nickel plated—large pile
C-746-E	pipes, mix and rings	Fe	N	C	73	0.04	3	small rings
C-746-E	pipes, mix and rings	Fe	N	C	86	0.05	4.3	large rings
C-746-E	pipes, mix and rings	Fe	N	C	10	0.5	5	iron nickel plate
C-746-E	pipes, mix and rings	Fe	N	C			7.5	iron mix
C-746-E	pipes, mix and rings	Fe	N	C			39	iron mix
C-746-E	pipe, mix and rings	Fe	N	C			71	misc. iron pipe
C-746-E	pipe, mix and rings	Fe	N	C	36	2.6	93.6	large diameter 1” thick rings
C-746-E	pipe, mix and rings	SS	N	C			4	stainless steel pipe
TOTAL C-746-E							**12,269.25**	

R5004991

APPENDIX C (continued)

Location	Scrap Description	Material	P – Packaged N – Not packaged	C – Contaminated U - Uncontaminated	Number Units	Unit Weight (Tons)	Amount (Tons)	Comments
C-746-E1, Contaminated Excess Metal Yards								
C-746-E1	covers, blades, and pipe	Al	N	C			21.5	Al covers and heat exchangers
C-746-E1	covers, blades, and pipe	Al	N	C			34.5	Al covers
C-746-E1	covers, blades, and pipe	Al	N	C			41.6	Al blades
C-746-E1	covers, blades, and pipe	Al	N	C			42	Al covers
C-746-E1	piles, converter, shells, nickel plated	Al	N	C			108	Al mix
C-746-E1	piles, converter, shells, nickel plated	Al	N	C			115	Al lids and compressors
C-746-E1	piles, converter, shells, nickel plated	Al	N	C			208	Al converter shells and blades
C-746-E1	piles, converter, shells, nickel plated	Al	N	C			741	Al mix, fins, shells
C-746-E1	covers, blades and pipe	Fe	N	C			31	iron—10" diameter pipe
C-746-E1	piles, converter, shells, nickel plated	Fe	N	C			10	iron—10" pipe
C-746-E1	piles, converter, shells, nickel plated	Fe	N	C	30	0.65	19.5	railroad rail
C-746-E1	piles, converter, shells, nickel plated	Fe	N	C	68	1.57	106.76	iron nickel-plated pipe shells
C-746-E1	piles, converter, shells, nickel plated	Fe	N	C			2,499	large pile
TOTAL C-746-E1							**3,977.86**	

R5004991

APPENDIX C (continued)

Location	Scrap Description	Material	P – Packaged N – Not packaged	C – Contaminated U - Uncontaminated	Number Units	Unit Weight (Tons)	Amount (Tons)	Comments
C-746-H4, Nickel Ingot								
C-746-H4	nickel yard	Al	P	C	186	0.65	121	Al ingots—1300 lb. each
C-746-H4	nickel yard	Al	P	C	1773	0.65	1,153	Al ingots—1300 lb. each
C-746-H4	nickel yard	Al	N	C			4.2	Al
C-746-H4	nickel yard	Al	N	C			48.7	Al ingots
C-746-H4	nickel yard	Ni	P	C			9,700	pure nickel ingots
TOTAL C-746-H4							**11,026.9**	
C-746-P East, Regulated Yard								
C-746-P East	mixed, misc.	Al	N	C			153.6	big pile 10% Al mixed
C-746-P East	wire, pipe, drums, and sheet	Al	N	C			0.5	Al pipe
C-746-P East	wire, pipe, drums, and sheet	Al	N	C			0.5	Al pipe
C-746-P East	mixed, misc.	Cu	N	C			2	Cu pipe
C-746-P East	mixed, misc.	Cu	N	C			2	transformers
C-746-P East	wire, pipe, drums, and sheet	Cu	N	C			1	Cu wire
C-746-P East	mixed, misc.	Fe	N	C			2	cabinets and lockers
C-746-P East	mixed, misc.	Fe	N	C			3.5	misc. iron mix
C-746-P East	mixed, misc.	Fe	N	C	8	0.68	5.5	railroad rails
C-746-P East	mixed, misc.	Fe	N	C			6	light structural and pipe
C-746-P East	mixed, misc.	Fe	N	C			8	transformers
C-746-P East	mixed, misc.	Fe	N	C	58	0.5	29	steel in insulators—no ceramic
C-746-P East	mixed, misc.	Fe	N	C	1	37	37	1 package mobile boiler
C-746-P East	mixed, misc.	Fe	N	C			1,382.4	big pile 90% iron mix
C-746-P East	wire, pipe, drums, and sheet	Fe	N	C			6	iron mix and drums
C-746-P East	wire, pipe, drums, and sheet	Fe	N	C			10	mix
C-746-P East	wire, pipe, drums, and sheet	Fe	N	C			12	galvanized pipe and sheet
C-746-P East	mixed, misc.	SS	N	C	2	6	12	pressure vessels
TOTAL C-746-P East							**1673**	

R5004991

APPENDIX C (continued)

Location	Scrap Description	Material	P – Packaged N – Not packaged	C – Contaminated U - Uncontaminated	Number Units	Unit Weight (Tons)	Amount (Tons)	Comments
C-746-P1, Clean Excess Metal Yard								
C-746-P1	misc., mesh, drums, pipe	Al	N	U			0.5	
C-746-P1	rail, pipe, motors, fan blades	Al	N	U			0.25	Al conduit
C-746-P1	rail, pipe, motors, fan blades	Al	N	U			3	Al blades
C-746-P1	rail, pipe, motors, fans	Al	N	U			3.5	pile 2
C-746-P1	misc., mesh, drums, pipe	Cu	N	U			1.5	Cu pipe sprinklers
C-746-P1	misc., mesh, drums, pipe	Cu	N	U			2	copper
C-746-P1	rail, pipe, motors, fan blades	Cu	N	U	9	0.1	0.9	motors
C-746-P1	rail, pipe, motors, fan blades	Cu	N	U			10	Cu heat exchanger tubing
C-746-P1	Misc., mesh, drums, pipe	Fe	N	U	2^+	0.125^+	0.5	refrigerators
C-746-P1	misc., mesh, drums, pipe	Fe	N	U			1	iron pipe
C-746-P1	misc., mesh, drums, pipe	Fe	N	U	200	0.0175	3.5	Drums
C-746-P1	misc., mesh, drums, pipe	Fe	N	U			5.5	iron rail
C-746-P1	misc., mesh, drums, pipe	Fe	N	U			9	railroad rail
C-746-P1	misc., mesh, drums, pipe	Fe	N	U			14	Carrier
C-746-P1	misc., mesh, drums, pipe	Fe	N	U			383	pile 1-20% light
C-746-P1	rail, pipe, motors, fan blades	Fe	N	U			2	pipe
C-746-P1	rail, pipe, motors, fan blades	Fe	N	U	9	0.4	3.6	motors
C-746-P1	rail, pipe, motors, fan blades	Fe	N	U	2	3.5	7	tanks
C-746-P1	rail, pipe, motors, fan blades	Fe	N	U			10	structural
C-746-P1	rail, pipe, motors, fan blades	Fe	N	U			12.8	pipe

APPENDIX C (continued)

Location	Scrap Description	Material	P – Packaged N – Not packaged	C – Contaminated U - Uncontaminated	Number Units	Unit Weight (Tons)	Amount (Tons)	Comments
C-746-P1	rail, pipe, motors, fan blades	Fe	N	U			15.5	iron pipe 19" diameter
C-746-P1	rail, pipe, motors, fan blades	Fe	N	U			327	railroad rail
C-746-P1	rail, pipe, motors, fans	Fe	N	U			1	misc. iron
C-746-P1	rail, pipe, motors, fans	Fe	N	U			11	cooling tower standoff pipe
C-746-P1	rail, pipe, motors, fans	Fe	N	U	59	0.65	38.35	railroad rail
C-746-P1	rail, pipe, motors, fans	Fe	N	U			41.5	pipe
C-746-P1	rail, pipe, motors, fan	Fe	N	U			31.5	pile 2 mixed, sheeting
C-746-P1	Misc., mesh, drums, pipe	SS	N	U			2	stainless steel mesh
C-746-P1	rail, pipe, motors, fan blades	SS	N	U			4.5	stainless steel pipe
TOTAL C-746-P1							**945.9**	
C-747-A UF_4 Drum Yard								
C-747-A UF_4 Drum Yard	drums and tanks	Fe	N	C	18^+	2.5^+	40.5	tanks
TOTAL C-747-A UF_4 Drum Yard							**40.5**	
C-747-B Scrap Yard*								
C-747-B	mixed	Al	N	C			1.25	Al compressor sections
C-747-B	mixed	Al	N	C			4.5	Al
C-747-B	pipe, gating, equipment	Fe	N	C			1	grating
C-747-B	pipe, gating, equipment	Fe	N	C	3	0.5	1.5	mobile units
C-747-B	pipe, gating, equipment	Fe	N	C			2	scrap
C-747-B	pipe, gating, equipment	Fe	N	C	1	4	4	mobile crane
C-747-B	pipe, gating, equipment	Fe	N	C			5	pipe
C-747-B	pipe, gating, equipment	Fe	N	C	2	3	6	trucks
C-747-B	pipe, gating, equipment	Fe	N	C			11	mobile units
C-747-B	pipe, gating, equipment	Fe	N	C	1	50	50	railroad flat car
C-747-B	pipe, gating, equipment	Fe	N	C	54	1.5	81	fork lifts

APPENDIX C (continued)

Location	Scrap Description	Material	P – Packaged N – Not packaged	C – Contaminated U - Uncontaminated	Number Units	Unit Weight (Tons)	Amount (Tons)	Comments
C-747-B	rail, tanks	Fe	N	C	1	4	4	tanks
C-747-B	rail, tanks	Fe	N	C	2	2	4	tanks
C-747-B	rail, tanks	Fe	N	C	134+	0.88+	81	rail
C-747-B	mixed	Fe	N	C	1	4	4	car
C-747-B	mixed	Fe	N	C	2	2.25	5	transfer cars
C-747-B	mixed	Fe	N	C	1	6	6	pump
C-747-B	mixed	Fe	N	C			7.5	douys, misc. iron
C-747-B	mixed	Fe	N	C			61.3	mixed iron
TOTAL C-747-B							**340.05**	

Note: The inventory does not include DMSA (3) East.

+From inventory, although amount is not consistent with these numbers.

*This includes DMSA (1) South/West.

Inventory by Metal Type (Tons)

Scrap Material	C-746-C	C-746-C1	C-746-D	C-746-E	C-746-E1	C-746-H4	C-746-P	C-746-P1	C-747-A	C-747-B	Totals
Aluminum	47.5	1,722.5	—	4.05	1,311.6	1,326.9	154.6	7.25	—	5.75	4,580.15
Nickel	—	—	—	—	—	9,700	—	—	—	—	9,700.00
Copper	2	21.6	—	—	—	—	5	14.4	—	—	43.00
Iron	4,685.95	1633.3	14,560	12,261.2	2,666.26	—	1,501.4	917.75	40.5	334.3	38,600.66
Stainless Steel	2	16.5	—	4	—	—	12	6.5	—	—	41.00
TOTALS	**4,737.45**	**3,393.9**	**14,560**	**12,269.25**	**3,977.86**	**11,026.9**	**1,673.0**	**945.9**	**40.5**	**340.05**	**52,964.81**

APPENDIX D

TECHNOLOGY SCREENING MATRIX

Appendix D. Technology Screening Matrix

Work Phase	Technology	Applicability	Worker Hazards	Secondary Waste	Manpower
Characterization					
Characterization	Process Knowledge	Cost-effective method to focus on potential contaminants of concern; however, limited availability of personnel with process knowledge.	Minimal.	None.	1-2 people.
	Visual Examination	Cost effective method to initiate characterization process, provide indicators for analytical requirements, and sort classified materials from non-classified materials.	Minimal General work hazards (foot, hand, eye, and contamination hazards).	None.	1-2 people.
	On-Site/Field Testing	Cost-effective, may not cover all required analyses.	Minimal General work hazards.	Minimal.	1-2 people.
	Laboratory Testing	May be required to profile wastes for disposal and for release of material. Requires more time for results.	Minimal General work hazards.	Minimal.	1-2 people.
	Automated Radiological Scanning	Efficient, cost-effective. May facilitate automated segregation of materials.	Minimal General work hazards.	None.	1-2 people.
Handling, Segregation, Sizing, and Volume Reduction					
Handling and Segregation	Bucket Loaders—track and rubber tired	Multi-purpose equipment for moving a variety of material and wastes, loading shredders, loading trucks, and general material movement.	General construction.	Used oil, filters, and parts.	2-4 people.

Appendix D (continued)

Work Phase	Technology	Applicability	Worker Hazards	Secondary Waste	Manpower
Handling and Segregation (cont.)	Cranes	Used for picking up and moving various materials. Stationary and multi-length telescoping booms. Variety of load capacities ranging from light loads to extremely heavy loads. Can be equipped with a variety of material/waste handling fixtures.	Elevated objects and materials. General construction.	Used oil, filters, and parts.	1-2 people.
	Electro-magnet Equipped Cranes	For moving ferrous materials and separating ferrous metals from non-ferrous materials.	Elevated objects. General construction.	Used oil, filters, and parts.	1-2 people.
	Fork Lifts	Used for moving scrap metal between staging areas. Also used for moving and handling materials placed on pallets. Routinely used for moving boxed materials and drummed materials. Can be equipped with a variety of material and container handling fixtures.	Elevated objects and materials. General construction.	Used oil, filters, and parts.	1-2 people.
	Trucks and Transport Wagons	Used to transport scrap materials between staging areas, processing areas, and shipment areas. Used to transport materials, supplies, and wastes on the site. Used to transport nickel ingots to on-site storage and transport waste to the on-site landfill.	General construction.	Used oil, filters, and parts.	1-10 people.
Sizing and Volume Reduction	Arc Saws	Suitable for thick (≤36") highly conductive metal components (stainless steel, high-alloy steel, aluminum, copper, Inconel).	Airborne contamination. Hydrogen produced if cutting Mg, Ti & Zr. Noise. Smoke.	Slag (minimal).	1-2 people.
	Abrasive Cutters	Used to cut pipe up to 60" diameter (t=4"), rotating disc abrades the metal being cut.	Sparking hazard. Noise. Eye protection.	Saw fines (minimal).	1-2 people.
	Abrasive Water Jets	Used for cutting concrete, stainless and carbon steel, and re-bar (water and abrasive).	Respiratory protection. Abrasions. Noise. Eye protection.	Water can be recycled, but requires filtration at significant additional cost.	1-2 people.

R5004991

Appendix D (continued)

Work Phase	Technology	Applicability	Worker Hazards	Secondary Waste	Manpower
Sizing and Volume Reduction (cont.)	Circular Cutting Saws – clamshell lathe or rotary cutter	Can cut pipe or round vessels with diameters up to 42" (t=6"), cut as they move around outside circumference on a track.	General construction. Noise. Eye protection.	Saw fines (minimal).	1-2 people.
	Compaction and Baling Equipment	Can be used to volume reduce a variety of materials. Produces baled materials that facilitate transportation and disposal activities. Extremely powerful equipment would be needed for processing metals. Compaction and baling of finely shredded metal may not be beneficial.	General worker hazards. Noise.	Used oil, filters, and parts.	2-3 people.
	Mobile Shears	Useful for cutting thick mild or stainless steel and concrete. Useful for cutting large and long pieces into smaller pieces to facilitate material handling and volume reduction by other equipment. Mobility would be useful in processing the various stockpiles of materials.	General construction. Eye protection.	Used oil, filters, and parts.	1-2 people.
	Nibbler/Shear	Typically used to cut thick sections of mild or stainless steel, best suited for small to moderate sized components.	General construction. Eye protection.	Minimal.	1-2 people.
	Plasma Arc	Used to cut thick metal components.	Eye protection. Heat exposure. Fire hazard.	Slag (minimal).	1-2 people.
	Oxyacetylene Torch	Typically used to cut structural steel, piping and components, maximum depth 4-6".	Eye protection. Heat exposure. Fire hazard.	Slag (minimal).	1-2 people.
	Shredders-hammermill and shear	Provides volume reduction of scrap metals to facility further processing, shipment, and final disposition. Size reduction permits processing through automated radiological screening equipment.	Rotating equipment. Noise. Large objects. General construction. Eye protection.	Used oil, filters, and parts.	1-2 people.

R5004991

Appendix D (continued)

Work Phase	Technology	Applicability	Worker Hazards	Secondary Waste	Manpower
Surface Decontamination					
Surface decon	CO_2 Pellet Blasting	Cleaning of concrete or metal surfaces w/o damage to substrate. Relatively expensive.	Noise (75-125 DB). CO_2 build-up. Eye protection. Respiratory protection.	Minimal.	3-4 people per system.
	Dry Grit Blasting	Cleaning of concrete, metal and lead bricks, can remove fixed contamination, not appropriate for glass, transite, etc. Readily available and widely used.	Respiratory protection. Abrasions. Noise. Eye protection.	Grit chips away substrate, generating contaminated secondary waste (grit and surface debris).	2-3 people per system.
	Electropolishing	Electric field pulls contamination from carbon and stainless steel components and dissolves particles in electrolyte (typically phosphoric, organic, or nitric acid).	Chemical splash. Generation of ignitable gases.	May require treatment, stabilization, and disposal of the final solutions and residues.	3-5 people per crew.
	Foam/Sponge Blasting	Sponge can be impregnated with variety of abrasive media for cleaning of concrete or metal surfaces.	Media dependent. Respiratory protection. Abrasions. Noise. Eye protection.	Media is recyclable (can be used 5-15 times), compacts well, and is incinerable.	2-3 people per system.
	Grinding/Honing	Can remove radiological contaminants from concrete and metal surfaces, HEPA-filtered vacuum systems attached to equipment to control contaminated dust.	Noise. Respiratory protection. Dose exposure. Joint fatigue. Eye protection.	Contaminated surface debris and dust from removing layers of target's surface.	2 people per crew.

R5004991

Appendix D (continued)

Work Phase	Technology	Applicability	Worker Hazards	Secondary Waste	Manpower
Surface decon (cont.)	High Pressure Water/Steam Blasting	Versatile, suitable for complex geometries, not applicable for wood.	Loss of limb. Infection. Noise. Respiratory protection. Eye protection.	Main drawback is the amount of contaminated wastewater generated. (30-52 gal/min for water blasting)	3-4 people per system.
	Hydrochloric Acid	Used to remove radiological contaminants and metal oxide films from metal surfaces to depths of ≤90 μm.	Chemical splash.	Solution of hydrochloric acid and dissolved contaminants. Mixed waste stream .	2-5 people per crew.
	Ice Blasting	Suitable for removing coatings and some fixed surface contamination from concrete and metal surfaces.	Noise. Abrasions. Respiratory protection. Eye protection.	Contaminated wastewater would require treatment. Recycling of water would require filtration.	3-4 people per system.
	Laser Etching/Ablation	Bare and coated concrete surfaces up to ¼" depth, time-consuming for complex geometry.	Laser exposure. Heat exposure.	None generated.	Unknown.
	Liquid Abrasive Blasting	Similar to dry grit blasting; however, abrasive is suspended in a medium of water.	Respiratory protection. Abrasions. Noise. Eye protection.	Abrasive is reclaimed and reused for a period of time; water, filters and surface debris make up secondary waste.	2-3 people per system.
	Manual Brushing/Wiping/ Scrubbing/ Vacuuming	Removal of contaminated dust and particles from smooth surfaces, not suitable for high dose environments.	Dose exposure. Respiratory protection. Fatigue. Personnel contamination.	Contaminated wash solution, HEPA filters and cleaning supplies.	2-3 people per system.

R5004991

Appendix D (continued)

Work Phase	Technology	Applicability	Worker Hazards	Secondary Waste	Manpower
Surface decon (cont.)	Nitric Acid	Removes uranium compounds from steel components, used as spray or in a bath for ultrasonic vibration or electropolishing.	Chemical splash.	Solution of nitric acid and dissolved contaminants, treatment required for waste stream. Mixed waste stream.	2-5 people per crew.
	Organic Acids	Removes contamination from steel, concrete, plastics, etc. (reacts slowly).	Chemical splash.	Treatment of waste stream required. Mixed waste stream.	2-5 people per crew.
	Oxalate Peroxide	Used to remove uranium compounds and films from the surfaces of steel components.	Chemical splash.	Treatment of waste stream required. Mixed waste stream.	3-4 people per crew.
	Plastic Bead Blasting	Similar to sponge blasting, uses plastic beads as the media, can remove fixed contamination.	Respiratory protection. Abrasions. Noise. Eye protection.	Media is recyclable and reusable but does not compact or incinerate well.	2-3 people per system.
	Rotating Brushes/Honing	Best suited for removal of contaminants from internal surfaces of pipe.	Dose exposure. Respiratory protection. Noise. Eye protection.	Contaminated surface debris and dust, HEPA filters used for dust control.	2-3 people per system.
	Scabbling/ Scarifying	Bare and coated concrete surfaces and subsurface, best suited for large surface areas.	Respiratory protection. Fatigue. Eye protection.	Many units have self-contained HEPA ventilation systems for dust and contaminant control, amount of secondary waste depends on the desired depth of concrete removal.	2 people per system.

Appendix D (continued)

Work Phase	Technology	Applicability	Worker Hazards	Secondary Waste	Manpower
Surface decon (cont.)	Soda Blasting	Carbonated water removes coatings and some fixed surface contamination from concrete and metal surfaces.	Noise. Respiratory protection. Eye protection.	Contaminated wastewater would require treatment. Recycling of water would require filtration.	3-4 people per system.
	Shot Blasting	Strips, cleans, and etches concrete and metal surfaces. Readily available and widely used.	Noise. Respiratory protection. Dose exposure. Eye protection.	Abrasives and surface debris, which are collected in a separation system for abrasive recycling and dust control.	2-3 people per system.
	Strippable Coatings	Used for decontaminating bare and coated surfaces.	Respiratory protection. Chemical handling.	Secondary waste made up of peeled contaminated coatings or flaked/cracked coatings.	2-3 people per crew.
	Ultrasonic Vibration	Suitable for removing loosely adhered contaminants from metallic components, inappropriate for larger items.	Noise. Depends on contents of cleaning solution.	Contaminated cleaning solution.	2-3 people per system.
Packaging					
Packaging	Concrete Casks	Useful for shielding properties. Heavy and bulky.	Dependent on properties of waste. Mishandling accident.	NA.	NA.
	Drum, polyethylene	85-gal capacity, can be used to overpack 55-gal drums. inside diameter – 27.5" inside height – 42"	Dependent on properties of waste. Mishandling accident.	NA.	NA.

R5004991

Appendix D (continued)

Work Phase	Technology	Applicability	Worker Hazards	Secondary Waste	Manpower
Packaging (cont.)	Drum, steel (55-gal)	55-gal capacity, can be used to overpack 30- and 20-gal drums. inside diameter – 22.5” inside height – 33”	Dependent on properties of waste. Mishandling accident.	NA.	NA.
	Drum, steel (85-gal)	85-gal capacity, can be used to overpack 55-gal drums. inside diameter – 26” inside height – 37”	Dependent on properties of waste. Mishandling accident.	NA.	NA.
	Fixative/stabilizer coatings	Various chemical agents can be used as thin films, thick coatings, or impregnated resins to fix or stabilize the contaminant in place.	Chemical handling.	None generated; however, underlying surface of item remains contaminated.	2-3 people per crew.
	Intermodal Containers	Used for shipping bulk volumes of materials and smaller containers of materials. Provides for efficient packaging of bulk volumes of materials to meet transportation ARARs.	Dependent on properties of waste. Mishandling accident.	NA.	NA.
	Mechanical Plastic Wrapping for Pallets	Used to secure objects to pallets that can be easily moved.	Dependent of properties of waste. Mishandling accident.	Plastic wrapping.	1-3 people per crew.
	Roll-off Containers	Useful for hauling bulk quantities of materials.	Dependent on properties of waste. Mishandling accident.	NA.	NA.
	Sea-Land Containers	Outside (8’ x 8’ x 20’) inside (7.68’ x 7.80’ x 19.5’) 1,164 ft^3 empty – 5,000 lb. max. payload – 48,000 lb.	Dependent on properties of waste. Mishandling accident.	NA.	NA.

Appendix D (continued)

Work Phase	Technology	Applicability	Worker Hazards	Secondary Waste	Manpower
	ST-5 Boxes (B-25)	Outside (43" x 53" x 77") inside (38" x 52" x 76") 87 ft^3 empty – 660 lb. max. payload – 5,340 lb.	Dependent on properties of waste. Mishandling accident.	NA.	NA.
		Shipping and Transportation			
Transportation	Trucks	Appropriate for small shipments, shipments to on-site facilities and transferring containerized waste to and from rail cars.	Transportation hazards.	NA.	2-10 people.
	Rail Cars	Bulk shipments, high capacity, and reduced transportation on pubic highways. Can be used in conjunction with trucks.	Transportation hazards.	NA.	3 people.
	Barges	Water route to disposal or processing facilities may not be available.	Transportation hazards.	NA.	NA.
		Storage			
Storage	Available PGDP Buildings	Large area needed, may not be available.	NA	NA.	NA.
	Rubberized Tent Structures	Relatively low cost in comparison to permanent structures. Large area required, large number of tents may be needed, design life may not meet requirements.	General construction. General industrial operations for facility maintenance.	NA.	NA.

76

R5004991

Appendix D (continued)

Work Phase	Technology	Applicability	Worker Hazards	Secondary Waste	Manpower
Storage (cont.)	Pre-fabricated Metal Building	Large area required, could be expensive to design and build.	General construction.	NA.	NA.
	Tumulus/Bunker	Used for long term storage of materials. Requires impermeable, structurally sound base; leachate collection and management; and engineered soil/geomembrane cover. Groundwater monitoring wells may be needed. Long term leachate management and cover maintenance required. May be perceived as disposal.	General construction. General industrial operations for facility maintenance.	NA.	NA.

Appendix D (continued)

Work Phase	Technology	Applicability	Requirements	Facility Management	Approval Required
Disposal					
Disposal	Sanitary/Industrial Waste Disposal	Suitable for sanitary and industrial wastes. Suitable for shredded scrap metal.	Scrap material or wastes would be required to meet facility waste acceptance criteria. Facility handling and disposal capacities must be sufficient to accept the scrap and waste volumes.	Commercial or government.	Negotiation, contracts and/or approvals required prior to transport of scrap material or wastes. Must ensure prior approvals for wastes volumetrically contaminated with residual radioactive materials prior to shipment.
	Low Level Waste Radioactive Waste Disposal	Suitable for low level radioactive waste disposal.	Scrap material and wastes would be required to meet facility waste acceptance criteria. Facility handling and disposal capacities must be sufficient to accept the scrap and waste volumes.	Commercial and government.	Negotiation, contracts and/or approvals required prior to transport of scrap material or wastes.
	Classified Waste Disposal	Suitable for classified, non-contaminated wastes and classified, low level radioactive wastes.	Scrap material and wastes would be required to meet facility waste acceptance criteria. Security features are required for classified wastes. Facility handling and disposal capacities must be sufficient to accept the scrap and waste volumes.	Government.	Negotiation, contracts, security plans and/or approvals required prior to transport of scrap material or wastes.

R5004991

Appendix D (continued)

Work Phase	Technology	Applicability	Requirements	Facility Management	Approval Required
Disposal (cont.)	Mixed Low Level Radioactive Waste Disposal	Suitable for low level radioactive wastes that are RCRA hazardous and/or PCB.	Scrap material and wastes would be required to meet facility waste acceptance criteria. Facility handling and disposal capacities must be sufficient to accept the scrap and waste volumes.	Commercial and government.	Negotiation, contracts and /or approvals required prior to transport of scrap material or wastes.
	Hazardous Waste Disposal	Facilities must be suitable for RCRA hazardous and/or PCB wastes.	Scrap material and wastes would be required to meet facility waste acceptance criteria. Facility handling and disposal capacities must be sufficient to accept the scrap and waste volumes. Wastes must meet DOE release criteria for radioactive materials	Commercial and government.	Negotiation, contracts and /or approvals required prior to transport of scrap material or wastes.

R5004991

APPENDIX E

SEDIMENTATION CONTROL

E.1 SEDIMENT CONTROL

This appendix documents and describes alternatives considered for sediment control that will be implemented for the scrap yards area at the Paducah Gaseous Diffusion Plant. Sediment control is required for the removal action to control stormwater flow and sediment transport. Any ditches or basins dug for the scrap yards would likely be dug into contaminated soil, directly affecting construction and soil disposal costs.

E.1.1 DRAINAGE AREA DESCRIPTION

The drainage area of scrap yards incorporates approximately 50.5 acres. This includes, in addition to the scrap yards, adjacent burial grounds that are located south of the yards. Also, the drainage ditch located just south of Patrol Road 2 also receives flow from areas east of 10th Street. The C-746-D Classified Scrap Yard is located apart from the other scrap yards. It is located on a concrete pad and drainage discharges through Outfall 010. Controls for the C-746-D Classified Scrap Yard is not required due to its location.

The topography of the scrap yards is relatively flat and runoff is generally radial. All sides of the scrap yards, expect C-746-D, border drainage ditches that eventually discharge through Outfall 001. Drainage on the south side of the scrap yards that include several burial grounds discharge to Outfall Ditch 001 that flows directly to Outfall 001. Drainage on the north side of the scrap yards is collected in the north drainage ditch, which flows, again to outfall 001. There exists a number of ditches within the scrap yards that aid flow from the yards to the bordering drainage ditches.

E.1.2 NATURE AND EXTENT OF SEDIMENT

The amount and type of sediment carried from the scrap yards during storm events is largely unknown at this time. In 1993, as part of an Interim Corrective Measure, silt fencing was installed around the perimeter of the scrap yards to minimize sediment transports. Since 1998, the KPDES permit for Outfall 001, to which the scrap yards runoff flows, has not included sampling for total suspended solids. Potential contaminants that could be mobilized during the removal action include radionuclides and metals.

E.2 REMOVAL ACTION OBJECTIVES FOR SEDIMENT CONTROL

The RAOs that have been established for sediment control are as follows:

- Control and reduce the amount of suspended solids that exit the 50.5-acre scrap yard area and that enter Outfall 001.
- Provide for sediment controls for the duration of the removal action.
- Provide action-specific sediment control measures for sediment loads caused by the removal action.

E.3 SEDIMENT CONTROL TECHNOLOGIES AND DEVELOPMENT OF ALTERNATIVES

E.3.1 SEDIMENT CONTROL MEASURES REQUIREMENTS

As stated previously, the total drainage area for the scrap yards is approximately 50.5 acres. At any one time no more than 10 acres of the scrap yards is expected to be disturbed. However, since there is a chance for more than 10 acres being disturbed, a sediment basin providing 3,600 cubic feet of storage per acre drained, or equivalent control measures, will be provided where attainable until final stabilization of the site is completed. This is a requirement referenced in guidance provided in *Storm Water Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices*, EPA-832-R92-005, September 1992, based on sediment basin requirements from EPA baseline general permit requirements. For purposes of design, sediment control measures established for the scrap yards will address a 2-year, 24-hour storm event. This event would result in a 3.5-inch rain during the course of 24 hours. Using the Soil Conservation Service's TR-55 model to estimate runoff, 6.7 acre-feet of water (approximately 2.2 million gallons) will run off during this storm event from the scrap yards area. The peak flow will be 34 cubic feet per second (cfs). Working backwards from the 3,600 cubic feet per acre guidance, a sediment basin constructed for a 2-year 24-hour storm event provides for storage of roughly 82 acres drained exceeding requirements set forth in guidance presented in EPA guidance (U.S. EPA 1992). Storm events of greater magnitude (e.g., 10-year 24-hour, 25-year 24-hour) could also be considered though it is believed that the 2-year 24-hour storm event design criteria provides for sufficient protection for downstream areas trapping sediment particles generated during removal action activities.

E.3.2 TECHNOLOGY IDENTIFICATION AND SCREENING

Several technologica are available to manage sediments in stormwater runoff. In addition to the standard sedimentation basin, other options include chemical treatment in conjunction with a basin, in-line treatment options, and conventional construction techniques (e.g., silt fencing, hay bales and gabions). A no action option is also considered. Discussion of these options and their relative effectiveness, implementability, and cost is provided below.

E.3.2.1 Sedimentation Basin Using Gravity Settling

As previously mentioned, sedimentation basins are a commonly used technology and are in widespread use. The basins are designed to be quiescent basins that will allow suspended solids in the water to settle by gravity at a constant settling velocity. Factors and conditions affecting the effectiveness of basins include the size and specific gravity of particles, the depth and shape of the basin, the flow patterns and currents, and temperature of the water. The stormwater is retained for a minimum specified time to allow the particles to settle.

Multiple design options and variations are available for sedimentation basins. For example, discharge can be either continuous, with horizontal flow velocities low enough for particles to settle before reaching the outlet, or the outlet can be closed to completely retain the stormwater flow from a specific storm event, with release at a later time. Outlet structures can be fixed, with a perforated riser pipe to drain the basin slowly, or floating outlet structures can be used. Regardless of the features specified in design, basins can be an effective and relatively low cost means of reducing suspended solids in water. Operating costs are relatively low.

E.3.2.2 Sedimentation Basin using Enhanced Settling

Chemicals can be added to sedimentation basins to enhance sedimentation. This is sometimes necessary to settle out small clay particles or colloids. Colloids behave very differently than other particles due to electrostatic forces acting upon them, which are greater than gravitational forces. These particles often never settle, regardless of the retention time provided. Chemical can be added to the turbid water to produce a flocculent that will carry down the particles with it. Polymers can also be used to entrain and destabilize particles.

Several chemicals are available to promote settling. Some of the most widely used chemicals include alum, ferric chloride, and polymers. All are effective, but the selection will likely depend on the amount and grain size distribution of the sediment expected from the scrap yards. Alum is often the least expensive to use. Dosing of polymers is sometimes difficult because both overdosing and underdosing can diminish effectiveness.

There are currently no limitations for sediment discharges under the NPDES permit for Outfall 001, enhanced settling methods may not need to be employed though they could be added during operation if necessary. Operating costs would be expected to be greater than for a basin alone.

E.3.2.3 Coagulation/Flocculation/Sedimentation in a Treatment Plant

A treatment plant similar to a municipal water treatment plant or the C-611 water plant at Paducah, could be used to treat the flow exiting from the scrap yards. Coagulation/flocculation and sedimentation would be employed, although filtration and disinfection, common at water plants, would not be necessary. Water plants can accommodate large flowrates, and the 2.2-million gallon runoff during a 24-hour period is treatable. However, water plants are typically designed to operate at a fairly constant flowrate, and the processes are not typically designed for wide variations in flow and sediment loading. Instead, the plant could be kept idle between storm events and operated during and after storms, but makeup water would have to be recirculated through the plant to keep the processes operating at the design flowrate.

The treatment plant would be somewhat impractical to operate with potentially large variations of flows and sediment loading. Costs would include both capital and substantial operating costs. A treatment plant would be generally more difficult to implement than a sediment basin for this removal action.

E.3.2.4 Filtration

A wide variety of filtration techniques are available to remove suspended solids from stormwater. The two most likely methods are fabric bag filters and sand filters. Either of these filter media could be designed to effectively remove sediment.

Due to the relatively flat terrain in the area, pumps would be required to send the stormwater through filters, as there would not be enough head to make the system work by gravity flow. With a peak runoff flow of 34 cfs, pumps would be needed, and a flow equalization basin would be required to prevent sizing the pumps to handle the peak flow. The pumps would also need to provide the necessary head to overcome the head loss of the filtration system. Head loss during filtration is a function of the filtration rate, filter media, and the accumulation of filtered particles. In addition, backup pumps and backup power would likely be required for operation if a pump has a malfunction or during a power outage. Filter backwash would be required when head loss reached a preset value. Sludge storage would be required during backwash.

Because of the necessity to use pumps, filtration as a control measure would be difficult to implement and would require substantial operating costs, although it could provide effective treatment. Due to greater implementabilty concerns, filtration is not considered as practical option for scrap yards sediment control.

E.3.2.5 Silt Fences, Hay Bales, and Gabion Structures

Silt fences, hay bales and gabion structures are very commonly used as low cost sediment control techniques on construction sites. However, due to the large flows and drainage area of Outfall 001, they may not be completely effective in controlling sediment transport. However, conventional construction techniques can be used near disturbed areas to minimize the mobilization of sediment towards drainage ditches during scrap removal. They can be applied to supplement other techniques and aid in maximizing the effectiveness of an overall scrap yard sediment control strategy.

E.3.2.6 No Sediment Control Measures (No Action Alternative)

If no measures are employed to minimize the transport of sediment from the scrap yards, contamination would be expected to be transported from the scrap yards during removal action activities. This practice is ineffective and unacceptable from a number of perspectives (e.g., regulatory, best management practices, etc.); therefore, this approach would not be considered based on its ineffectiveness.

E.3.3 DEVELOPMENT OF A PREFERRED ALTERNATIVE

Based on the previous identification of sediment control technologies, construction of a sediment basin and utilization of conventional construction techniques in close proximity to removal action activities are selected as the preferred sediment control measures to employ. The design basis for the basin considered here, as stated previously, addresses a 2-year 24-hour storm event. The use of conventional construction sediment control techniques along with the construction of a 2-year 24-hour storm event sediment basin should provide adequate protection from potential risks over the duration of the fieldwork. Details about the sediment basin design will be further defined in the Removal Action Work Plan. Design considerations as they relate to effectiveness, implementability and cost are discussed in the following sections.

E.4 ANALYSIS OF SEDIMENT CONTROL ALTERNATIVE

A sedimentation basin appears to be the best alternative to implement for the scrap yards removal action. Several key design criteria will need to be carefully evaluated in the final design of the basin to ensure the best cost-benefit. These criteria can have large impacts on cost, basin size, and constructability.

A conceptual basin design has been laid out, as shown in Figures E-1 and E-2. The outer footprint of the excavated area is 1.5 acres. Approximately 6 feet of soil would be excavated inside this footprint using side slopes of 3:1 to reach the bottom of the ditch inverts. Once at this level, the storage volume for the stormwater can be excavated, which is an additional 8 feet of excavation. A total of 25,243 cubic yards of soil will be excavated. The eight feet of storage volume includes storage volume for sediment. The stormwater storage volume would be able to be drained by gravity through a floating outlet. A preferred location for the basin would be near the Outfall 001 drainage ditch, which would receive its discharge. If the basin's capacity was exceeded, a spillway would route the excess stormwater to the drainage ditch.

Discussions of effectiveness, implementability, and cost for sedimentation basins are provided below.

E.4.1 EFFECTIVENESS

Sedimentation basins are very effective at removal of large- and medium-sized particles. However, effectiveness to remove small clay particles depends on the basin design, and moreover, colloidal particles usually cannot be settled by gravity settling alone. Unfortunately, the grain size distribution of the Outfall 001 sediments are not know at this time, so it is difficult to predict if colloids are present or if the fine particles can be settled. Operational experience of the sedimentation basin at the Paducah Plant's C-746-U landfill has indicated that problems settling colloidal particles has occurred, particularly in wintertime when the density of the water is greater. Outfall 001, where potential scrap yard sediments are discharged, does not have any existing sediment discharge limits; therefore, no chemical addition will be assumed for the initial design assumptions. Chemical addition could be added at a future date if necessary.

E.4.2 IMPLEMENTABILITY

A sedimentation basin is implementable for the scrap yards, although there are several major design issues to be considered, primarily due to the topography of the area, adjacent burial grounds, and the flowrates to be addressed. Some of the design options are discussed in this section.

One major implementability issue is the required depth and location of the new drainage ditch needed just north of the Outfall 001 drainage ditch. The new ditch, needed to prevent runoff into the Outfall 001 drainage ditch, will need to be dug near the edge of a classified burial ground. There is the potential for classified material to be unearthed during ditch construction. Special provisions will need to be made to ensure security is maintained.

Another consideration is the size of the basin and the earthwork required for its construction. Multiple pieces of large earth moving equipment will be required to complete construction in a timely manner. A spoils area will also be required for the excavated soil. The undeveloped area of the C-746-U landfill is the most likely location at this time.

A major design and operational parameter is whether or not the basin has a continuous-flow outlet or not. The basin size could be smaller if outflow is allowed while the basin level is still rising. However, designing the basin to hold the entire 2-year storm event with the outlet plugged provides the advantage of complete retention if the discharge limits will not be met or if there is a release.

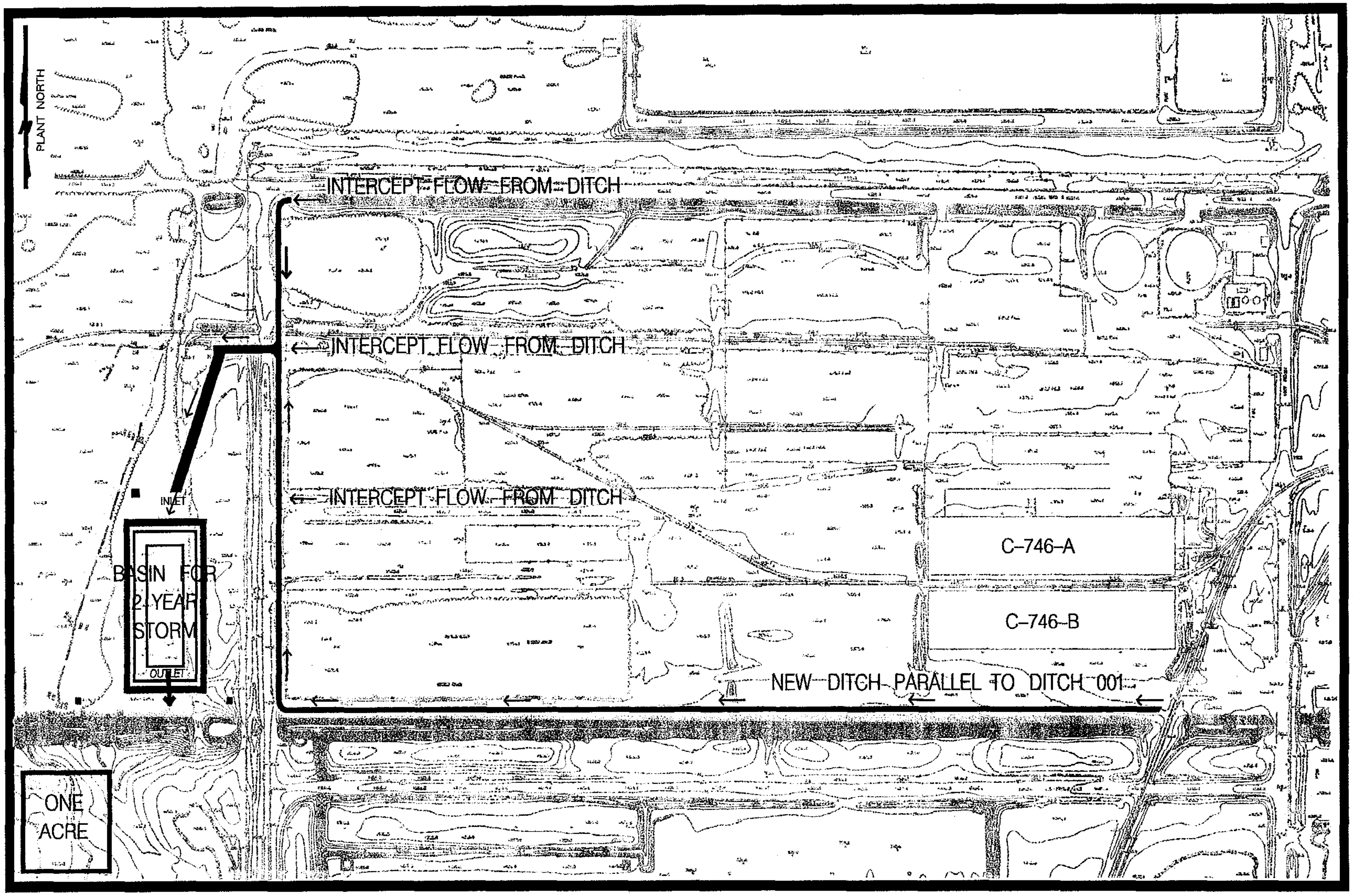

Fig. E-1. Collection of storm water from the scrap metal yards.

86

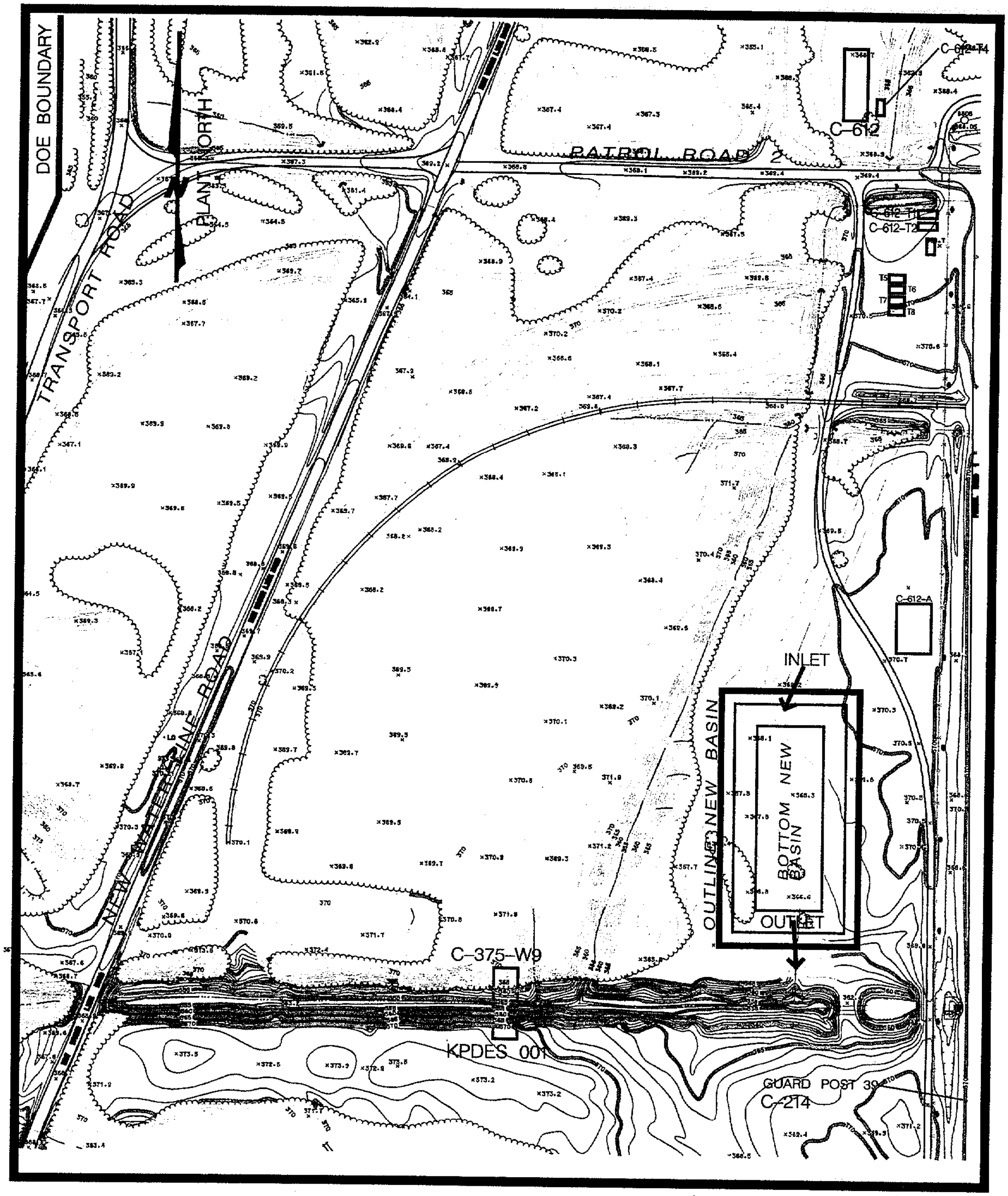

Fig. E-2. Conceptual basin layout, scrap yards, 2-year 24-hour storm event.

Even though there are numerous implementability concerns, the basin can still be built and operated for the scrap yards. Compared with the other alternatives considered (but ruled out) in the previous section, the sediment basin is still the most implementable means of addressing sediment control for this removal action.

E.4.3 COST

The direct capital costs of the conceptual sediment basin for the scrap yards is $1,058,000. This cost is reflected in the total cost of the removal action. A detailed cost summary is presented in Table E.1. This cost can be greatly affected by the assumptions made for the basin.

E.5 REFERENCES

U.S. EPA 1992, *Storm Water Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices*, EPA-832-R92-005, September.

R5004991

PADUCAH GASEOUS DIFFUSION
PADUCAH, KENTUCKY
SCRAP METAL YARD - 2-YR, 24-HR STORM WATER RUNOFF CONTROL DETAILED ESTIMATE

CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
1 PROJECT PLANNING											
1.1 Prepare Project Plans	1000	hr			$33.79		$0	$0	$33,790	$0	$33,790
1.2 Project Scheduling and Procurement	200	hr			$33.79		$0	$0	$6,758	$0	$6,758
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc., Loader, & Dozer)	10	ea			$200.00	$250.00	$0	$0	$2,000	$2,500	$4,500
2.2 Mobilize/Demobilize Personnel (3-persons)	10	ea		$375.00	$300.00		$0	$3,750	$3,000	$0	$6,750
2.3 Portable Toilet	3	mo	74				$223	$0	$0	$0	$223
2.4 Storage Trailer (28' x 10')	3	mo	98				$295	$0	$0	$0	$295
2.5 Office Trailer (32' x 8')	3	mo	221				$664	$0	$0	$0	$664
2.6 Site Utilities	3	mo	1,000				$3,000	$0	$0	$0	$3,000
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$450.00	$400.00	$155.00	$0	$450	$400	$155	$1,005
3.2 Decon Water Disposal	50	drum	125				$6,250	$0	$0	$0	$6,250
3.3 Decon Water Storage Drums	50	ea		$45.00			$0	$2,250	$0	$0	$2,250
3.4 PPE (3 p * 5 days * 22 Weeks)	330	m-day		$30.00			$0	$9,900	$0	$0	$9,900
3.5 Decontaminate Equipment (Pressure Washer)	6	ea			$134.45	$50.00	$0	$0	$807	$300	$1,107
3.6 Decontamination Trailer (24' x 8')		mo	2,325				$0	$0	$0	$0	$0
3.7 Clean Water Storage Tank, 4,000 gallon		mo	473				$0	$0	$0	$0	$0
4 SITE PREPARATION											
4.1 Erosion Control Fencing	2000	lf		$0.23	$1.17		$0	$460	$2,340	$0	$2,800
4.2 Construction Surveys (2-man crew)	90	day	648				$58,352	$0	$0	$0	$58,352
4.3 Utility Location and Site Delineation/Layout	80	hrs			$33.23		$0	$0	$2,658	$0	$2,658
4.5 Concrete Demolition/Removal (6" reinforced)		cy	46				$0	$0	$0	$0	$0
4.6 Concrete Debris Disposal		cy	21				$0	$0	$0	$0	$0
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (21 cy, 1/4 dozer & 5000' haul	25243	cy			$0.93	$5.40	$0	$0	$23,476	$136,312	$159,788
5.2 Standby, 21 cy scraper	80	hrs				$37.54	$0	$0	$0	$3,003	$3,003
5.3 Wheel Loader, 3 cy	500	hrs			$27.20	$56.31	$0	$0	$13,600	$28,155	$41,756
5.4 Standby, Wheel Loader, 3 cy	80	hrs				$14.07	$0	$0	$0	$1,126	$1,126
5.5 Health & Safety Monitoring with OVA during Excavation		day			$188.16	$100.00	$0	$0	$0	$0	$0
5.6 Collect/Analyze Confirmatory Samples		ea	410	$10.00	$23.52		$0	$0	$0	$0	$0
5.7 Import (Offsite) Place, Compact Clean Fill Material		cy		$7.82	$0.85	$1.81	$0	$0	$0	$0	$0
5.8 Backfill with Clean Excavated Material		cy		$0.28	$2.02	$0.76	$0	$0	$0	$0	$0
6 BASIN											
6.1 Fencing	2000	ft		$7.25	$2.57	$1.83	$0	$14,500	$5,140	$3,660	$23,300
6.2 Maintenance Road and Disposal Road (9" 1-1/2" base gravel)	5556	sy		$8.90	$0.36	$0.69	$0	$49,444	$2,000	$3,833	$55,278
6.3 Inlet Structures (16' h, 12'w, reinforced)	250	lf		$71.00	$143.00		$0	$17,750	$35,750	$0	$53,500
6.4 Outlet Structures	100	lf		$71.00	$143.00		$0	$7,100	$14,300	$0	$21,400
6.5 Culvert Rehabilitation	1	ls	25,000				$25,000	$0	$0	$0	$25,000
6.6 Collection Trench (4' to 6' deep, 0.5 cy backhoe)	8211	cy			$2.18	$3.09	$0	$0	$17,900	$25,372	$43,273
6.7 Pump Station (1000 gpm)	1	ls	108,500				$108,500	$0	$0	$0	$108,500
6.8 Waste Disposal of 10% of Trench Excavation	821	cy	483				$396,318	$0	$0	$0	$396,318
6.9 Floating Outlets	2	ea	10,000				$20,000	$0	$0	$0	$20,000
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile		ls	750				$0	$0	$0	$0	$0
6.2 Transport and Dispose of Soil (Non-haz.) in Landfill		ton	45				$0	$0	$0	$0	$0
6.3 Prepare Shipment Manifests		hrs			$33.23		$0	$0	$0	$0	$0
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)	807	cy		$15.00			$0	$12,100	$0	$0	$12,100
7.2 Place/Grade Topsoil (6")	5	day			$227.20	$435.00	$0	$0	$1,136	$2,175	$3,311
7.3 Seed Disturbed Area	87.12	1000 sf		$23.00	$7.40	$7.85	$0	$2,004	$645	$684	$3,332
7.4 Concrete Slab (Reinforced) on Grade (6")		sf	4				$0	$0	$0	$0	$0
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)		days	648				$0	$0	$0	$0	$0
8.2 Prepare Land Use Plan		hours			$33.79		$0	$0	$0	$0	$0
8.3 Modify Master Plan and Prepare Deed Restrictions		hours			$33.79		$0	$0	$0	$0	$0
Subtotal Direct Capital Costs Including Subcontract							$618,602	$119,708	$165,700	$207,276	$1,111,286
Local Area Adjustment								89%	89%	89%	
Adjusted Subtotal Direct Capital Costs Including Subcontract							$618,602	$106,780	$147,804	$184,890	$1,058,076

Table E.1 Conceptual sediment basin cost estimate.

APPENDIX F

DETAILED COST ESTIMATE

F.1. COST ESTIMATE FOR PREFERRED ALTERNATIVE

This appendix provides the basis for the cost estimate, summary cost information, assumptions, estimate details, and pricing data used in developing the cost estimate for the Preferred Alternative, Alternative 3. It should be noted that the methodologies and proportionate quantities assumed for development of the cost estimate may not be those that occur in practice when the removal action is contracted for and actually performed.

F.1.1. DESCRIPTION OF PREFERRED ALTERNATIVE

The Scrap Removal and Disposition with Nickel Ingot Storage alternative (Alternative 3) consists of removal of all scrap material from the yards and other areas, processing of the material, appropriate disposition (e.g., disposal, recycling, etc.), and storage of nickel ingots. For the purposes of the cost estimate it is assumed that shear shredders are utilized for metal processing. The actual technology selected will be determined by the successful bidder for the implementation contract.

Scrap material would initially be inspected, sorted and segregated to enable appropriate disposition. If found, potential RCRA hazardous, PCB, and ACM wastes would be segregated for separate processing. Scrap material, designated for disposal, would initially undergo size reduction by shearing to facilitate material handling and processing through the shredding equipment. A portion of the scrap material can be expected to be to bulky precluding it from being size reduced. This material will be staged and processed separately from size reduced material. Shredding would be accomplished in two stages first through a course shredder and then a fine shredder to achieve a fairly uniform material size of about one ich wide by two or three inches long. The finely shredded material would be processed through automated radiological screening and sorting equipment to segregate radiologically contaminated materials from materials with residual levels of radioactive materials that do not require management as low level radioactive waste.

Scrap materials, non-metallic wastes and debris not requiring management as low level radioactive waste, RCRA hazardous, PCB, or mixed wastes, and meeting the disposal criteria for the PGDP C-746-U Solid Waste Landfill, would be transported by truck and disposed of in the landfill.

Scrap material requiring off-site disposal would be loaded into intermodal containers and staged for transportation to the appropriate disposal facility. Samples would be collected from the shredded scrap for characterizing each container of material. The containerized materials meeting applicable WAC would be transported by rail and disposed of at the Nevada Test Site in Mercury, Nevada. Classified scrap material, meeting appropriate WAC, would also be transported by rail and disposed of at the Nevada Test Site. An optional disposal facility would be the Hanford Site, in Richland, Washington. Scrap material identified as mixed waste, again meeting the applicable WAC, would be transported by rail and disposed of at Envirocare of Utah in Clive, Utah.

In the event it is determined that some scrap is appropriate for recycle, it will be handled in accordance with DOE Orders and ARARs detailed in Appendix A. Factors considered in determining appropriateness for recycling will include process knowledge, potential economic value of scrap, cost of necessary characterization and decontamination, and risks associated with decontamination and recycling of the scrap. Only surface-contaminated material that can be expected to be successfully decontaminated and potential clean materials that meet release criteria would be eligible for consideration for recycle. Volumetrically contaminated material would not be considered for recycle.

Nickel ingots stored at the C-746-H4 Scrap Yard would be relocated and stored in rubberized tension structures within the PGDP security fences. Rubberized tent structures would be constructed on-site as a part of site improvements.

F.1.1.1. Environmental, Safety and Health

Implementation of an Integrated Safety Management System during scrap processing would promote integration of safety into all aspects of work planning and execution. Environmental, safety, and health (ES&H) risk and vulnerabilities (including criticality) would be identified, communicated, and appropriately incorporated into planning. Participation by all personnel would be essential to ensure that all job-specific hazards are identified and appropriate controls are implemented. A project-specific ES&H Plan would detail requirements and methods intended to protect human health and the environment during scrap processing. Air emission and radiological monitoring would be performed during all phases of the scrap metal processing. Radiological and environmental controls, specifically sediment runoffs control provisions and wildlife management, would be put in place, prior to initiating scrap metal removal, to minimize the potential for migration of contamination during scrap processing. Sediment runoff control provisions include silt fences, hay bales, localized diking, and a constructed sediment basin for the scrap yard drainage area.

F.1.1.2 Scrap Material Disposition Assumptions

Based on process knowledge, scrap inventory, limited contamination information, and surface contamination calculations, actions have been identified for the scrap material as part of the overall preferred alternative to assist in the preparation of a cost estimate for Alternative 3. Although specific actions have been used in preparing the cost estimate, depending on the nature of the scrap, the actual processing methods and disposition employed during the implementation of the work could differ.

Estimated quantities of scrap material that would be stored or otherwise dispositioned are detailed in Table F.1. Cost estimate assumptions for Alternative 3 are detailed in this Section F.3. It is assumed that 50% of scrap material (excluding classified material, RCRA, TSCA, ACM, etc.) will be disposed on in the C-746-U Solid Waste Landfill.

Table F.1 Scrap Removal and Disposition with Nickel Ingot Storage (estimated values)

Scrap material	On-site storage (tons)	On-site disposal tonnage (tons)	On-site disposal volume (ft3)	Off-site disposal tonnage (tons)	Off-site disposal volume (ft3)	Totals tonnage (tons)	Totals volume (ft3)
Aluminum		1,554	47,815	1,699	52,277	3,253	100,092
Nickel	9,700					9,700	
Copper		21	646	22	677	43	1,323
Iron	45	11,442	352,062	13,278	408,554	24,765	760,616
Stainless steel		21	646	20	615	41	1,261
Classified scrap				15,887	431,320	15,887	431,320
Wood		234	11,190	308	14,667	542	25,857
Totals	9,745	13,272	412,359	31,214	908,110	54,231	1,320,469

Nickel-Plated Steel

Nickel-plated steel from the C-746-C, C-746-C1, C-746-E, and C-746-E1 scrap yards (~15,544 tons) would be spread, sorted, decontaminated if required, sized, shredded, radiologically segregated, and characterized to meet the WAC for an appropriate disposal facility. A portion of the steel would too bulky for shredding and thus would not be size reduced but would be characterized separately using manually operated instrumentation. It is assumed that 50% of the nickel-plated steel can be disposed of at the PGDP Solid Waste C-746-U Landfill. This material would be bulk staged and, after receiving authorization, would be loaded into dump trucks and transported to the PGDP Landfill for disposal. The remaining 50% would be loaded into intermodal containers, staged, and after receiving authorization, transported by rail/truck and disposed of at an appropriate disposal facility.

Nickel Ingots

Nickel ingots (~9700 tons) from the C-746-H4 scrap yard would be relocated by truck to a newly constructed on-site storage facility. The volumetrically contaminated nickel, which has substantial financial value, would be compliantly managed and stored on-site for an assumed 30-year period.

Classified Aluminum

Classified aluminum (~1327 tons) from the C-746-D Classified Scrap Metal Yard (moved from C-746-C1 in 1997) would be inspected and characterized to meet the WAC for an appropriate disposal facility. Material would be loaded into sealand containers for transport and disposal. Additional precautions would be taken to ensure security requirements are met. Work would be conducted under an approved security plan. The scrap material would be transported by rail/truck to an appropriate disposal facility. This work can be performed prior to construction of sediment control measures since the aluminum is stored on a concrete pad and removal will not mobilize any sediment.

Classified Steel

Classified steel (~14,560 tons) from the C-746-D Classified Scrap Metal Yard would be inspected, size reduced if required and characterized to meet the WAC for an appropriate disposal facility. Material would be loaded into sealand containers for transport and disposal. Additional precautions would be taken to ensure security requirements are met. Work would be conducted under an approved security plan. The scrap material would be transported by rail/truck to an appropriate disposal facility.

Steel C-747-A Drum Yard

Remaining steel from the C-747-A Drum Yard (~40.5 tons) would be spread, sorted, decontaminated, sized, shredded, radiologically segregated, and characterized to meet the WAC for an appropriate disposal facility. Again, it is assumed that 50% of the steel can be disposed of at the PGDP Solid Waste C-746-U Landfill. This material would be bulk staged and, after receiving authorization, would be loaded into dump trucks and transported to the PGDP Landfill for disposal. The remaining 50% would be loaded into intermodal containers, staged, and, after receiving authorization, transported by rail/truck and disposed of at an appropriate disposal facility.

Mixed Scrap C-746-P1 Scrap Yard

Scrap material from the C-746-P1 Scrap Metal Yard (~908 tons) would be spread, sorted, decontaminated if required, sized, shredded, radiologically segregated, and characterized to meet the WAC for an appropriate disposal facility. A portion of the steel would too bulky for shredding and thus would not be size reduced but would be characterized separately using manually operated instrumentation. It is assumed that 50% of the remaining mixed scrap can be disposed of at the PGDP Solid Waste C-746-U Landfill. This material would be bulk staged and, after receiving authorization, would be loaded into dump trucks and transported to the PGDP Landfill for disposal. The remaining 50% would be loaded into intermodal containers, staged, and, after receiving authorization, transported by rail/truck and disposed of at an appropriate disposal facility.

Mixed Scrap Materials

Mixed scrap materials from non-segregated scrap metal piles in C-746-C, C-746-C1, and C-746-P (~8197 tons) would be spread, sorted, decontaminated if required, sized, shredded, radiologically segregated, and characterized to meet the WAC for an appropriate disposal facility. A portion of the steel would too bulky for shredding and thus would not be size reduced but would be characterized separately using manually operated instrumentation. It is assumed that 50% of the remaining mixed scrap can be disposed of at the PGDP Solid Waste C-746-U Landfill. This material would be bulk staged and, after receiving authorization, would be loaded into dump trucks and transported to the PGDP Landfill for disposal. The remaining 50% would be loaded into intermodal containers, staged, and, after receiving authorization, transported by rail/truck and disposed of at an appropriate disposal facility.

Motor Vehicles and Fork Trucks

Surplus motor vehicles and contaminated fork trucks (~79.5 tons) would be sorted, sized, decontaminated if required, processed if required, radiologically segregated, and characterized to meet the WAC for an appropriate disposal facility. It is assumed that 50% of the mixed scrap can be disposed of at the PGDP Solid Waste C-746-U Landfill. This material would be bulk staged and, after receiving authorization would be loaded into dump trucks and transported to the PGDP Landfill for disposal. The remaining 50% would be loaded into intermodal containers, staged, and after receiving authorization, transported by rail and disposed of at an appropriate disposal facility.

Contaminated Wood

Contaminated wood from the C-746-C, C-746-C1, C-746-E, C-746-E1, and C-747-B scrap yards (~542 tons) would be spread, sorted, sized, shredded, radiologically segregated, and characterized to meet the WAC for an appropriate disposal facility. It is assumed that 50% of the wood can be disposed of at the PGDP Solid Waste C-746-U Landfill. This material would be bulk staged and, after receiving authorization, would be loaded into dump trucks and transported to the PGDP Landfill for disposal. The remaining 50% would be loaded into intermodal containers, staged, and, after receiving authorization, transported by rail/truck and disposed of at an appropriate disposal facility.

Metal Turnings

Scrap metal turnings from the C-746-C, C-746-C1, C-746-E, C-746-E1, and C-747-B scrap yards (~160 tons) would be spread, sorted, sized, shredded, radiologically segregated, and characterized to meet the WAC for an appropriate disposal facility. The material, suspected to contain constituents regulated under RCRA, would be loaded into intermodal containers, staged and, after receiving authorization, transported by rail and disposed of at an appropriate disposal facility.

Aluminum

Scrap aluminum from C-746-E, C-746-E1, C-746-C, and C-746-C1 would be spread, sorted, sized, decontaminated if required, shredded, radiologically segregated, and characterized to meet the WAC for an appropriate disposal facility. A portion of the aluminum would too bulky for shredding and thus would not be size reduced but would be characterized separately using manually operated instrumentation. It is assumed that 50% of the remaining aluminum scrap can be disposed of at the PGDP Solid Waste C-746-U Landfill. This material would be bulk staged, and after receiving authorization, would be loaded into dump trucks and transported to PGDP Landfill for disposal. The remaining 50% would be loaded into intermodal containers, staged, and, after receiving authorization, transported by rail/truck and disposed of at an appropriate disposal facility.

Regulated Materials

There is the potential for the discovery of regulated materials (TSCA, RCRA, and ACM) within the scrap materials during processing. Processing of 4,800 ft^3 (50 B-25 Boxes) of TSCA and 4,800 ft^3 (50 B-25 Boxes) of RCRA LLW (~90 tons or 0.2% of total scrap material) is incorporated into the preferred alternative cost estimate. If identified, regulated material would be segregated, characterized, and compliantly managed. RCRA LLW scrap material, meeting an appropriate commercial disposal facility WAC, would be loaded on rail cars and transported for disposal. If a waste is identified for which no disposal facility is available (i.e., classified mixed waste, classified RCRA waste, or PCB low level radioactive waste), these wastes would be stored in appropriate facilities at PGDP.

F.1.2. PROJECT SUMMARY WORK BREAKDOWN STRUCTURE

The Work Breakdown Structure (WBS) elements are numbered from 1 to 10 and are structured to identify expected costs associated with execution of each step of the removal action. Table F.2 shows material and labor costs for each WBS element, overhead applied and total costs. In addition, the cost estimate was escalated to show actual budget needs. The following represents the WBS used in generating the cost estimate for the preferred alternative.

WBS Elements

1. RFP Preparation and Subcontract Administration

   Work element includes support for preparation of performance specifications, request for proposals, proposal reviews, and award of subcontracts.

   1.1 Security
   1.2 Procurement
   1.3 Performance/Quality Assurance
   1.4 Field Services Management
   1.5 Environmental Safety and Health
   1.6 Project Management
   1.7 Nuclear Criticality Safety
   1.8 Engineering

2. M&I Oversight of Subcontract

   This element includes support for oversight of the subcontract during project execution. This includes effort for the subcontract technical representative as well as support organization (engineering, project controls, environmental safety and health, etc.).

   2.1 Classification

2.2 Security
2.3 Engineering (Contract Management)
2.4 Procurement
2.5 Performance/Quality Assurance
2.6 Project Controls
2.7 Engineering (Waste Management)
2.8 Field Services (Contract Management)
2.9 Environmental Safety and Health
2.10 Security
2.11 Environmental Safety and Health (Health Physics)
2.12 Engineering (DOT Oversight)

3. Mobilization

Work element includes cost for the establishment of subcontractor facilities, utility hook-ups, and worker training.

3.1 Office Trailers and Equipment
3.2 Utilities Service
3.3 Personnel Training
3.4 Tension Structures (classified area and main scrap yard area)
3.5 Security Fencing (classified area work)
3.6 Automated Radiation Monitoring System
3.7 Gravel For Work Areas

4. Major Procurements

This element includes cost for the procurement of three shredders for scrap material size reduction, portable scales and sealand containers for disposal of classified materials.

4.1 Scrap Shredders and Replacement Blades
4.2 Portable Scales
4.3 Sealand Containers
4.4 Conveyor Systems

5. Site Improvements

This element includes cost for erecting a storage structure for the nickel ingots, railroad rail and rail upgrades, the plugging and abandonment of a bedrock groundwater well, installation of a new bedrock groundwater well, and design and construction of sediment control measures.

5.1 Nickel Ingot Storage Structure
5.2 Railroad Rail and Rail Upgrades
5.3 Groundwater Well P&A
5.4 Groundwater Well Installation
5.5 Sediment Control Measures Basin Construction (reported separately)

6. Scrap Metal Processing

This element includes costs for processing scrap metal, scrap characterization, decontamination, and loading intermodal and/or sealand containers.

- 6.1 Spread, Sort, Inspect and Segregate Scrap Metal, Non-Scrap Metal, Debris
  - 6.1.1 Labor
  - 6.1.2 Material
- 6.2 Size Reduce Scrap Metal
  - 6.2.1 Labor
  - 6.2.2 Material
- 6.3 Process Scrap Metal
  - 6.3.1 Labor
  - 6.3.2 Material
- 6.4 Characterize Scrap Metal and Monitor Site Conditions
  - 6.4.1 Labor
  - 6.4.2 Material
- 6.5 Surface Decontamination
  - 6.5.1 Labor
  - 6.5.2 Material
- 6.6 Radiological Characterization/Scrap Segregation
  - 6.6.1 Labor
  - 6.6.2 Material
- 6.7 Load Scrap into Intermodal Containers/Stage Scrap
  - 6.7.1 Labor
  - 6.7.2 Material

7. Load Rail Cars
- 7.1 Labor
- 7.2 Material

8. Transport Scrap Metal for Disposal (on-site/off-site)
- 8.1 Labor
- 8.2 Material

9. Scrap Disposal
- 9.1 Labor
- 9.2 Material

10. Demobilization
- 10.1 Landscaping
  - 10.1.1 Labor
  - 10.1.2 Material

10.2 Final Report
- 10.2.1 Labor
- 10.2.2 Material

10.3 Equipment Decontamination and Removal
- 10.3.1 Labor
- 10.3.2 Material

F.1.3. SUMMARY COST DATA

Table F.2 summarizes the cost estimate for this alternative. The cost estimate was escalated at a rate of 2.1% per year.

Table F.2. Summary Cost Estimate for Alternative 3

Work Breakdown Structure Elements	Labor $	Material $	Total $
RFP Preparation and Contract Administration	82,597	0	82,597
Management & Integration Oversight of Subcontract	1,697,230	94,124	1,697,230
Contractor Mobilization	98,637	827,410	926,047
Major Procurements	0	3,840,520	3,840,520
Site Improvements	68,199	835,993	904,192
Sediment Control Provisions	147,804	910,272	1,058,076
Spread, Sort, Inspect and Segregate Scrap Metal, Non-Scrap Metal, and Debris	97,305	135,932	233,237
Size Reduce Scrap Metal	358,502	500,813	859,315
Shred Scrap Metal	483,194	436,990	920,184
Characterize Scrap Metal (Collect And Analyze Samples)	111,370	11,432,836	11,544,206
Preparatory Surface Decontamination	15,531	15882	31,013
Radiological Characterization/Scrap Segregation	345,174	1,222,785	1,567,959
Load Scrap Into Intermodal Containers/Stage Scrap	53,394	77,396	130,790
Load Rail Cars	347,231	267,069	614,300
Transport Scrap Metal For Disposal (Off-site/On-site)	89,486	7,908,497	7,997,983
Dispose of Scrap	0	8,758,534	8,758,534
Contractor Demobilization	23,904	55,104	79,008
Scrap Yard Operation and Maintenance	0	1,822,974	1,822,974 [a]
Subtotal of Direct Costs	4,019,920	39,142,731	43,162,651
Burden @ 30% of Labor Costs	1,205,976		1,205,976
Total Direct Cost	5,225,896	39,142,731	44,368,627
Indirects @ 26% of Total Direct Cost	1,358,733	10,177,110	11,535,843
Total Indirect & Direct Costs			55,904,470
Sales Tax @ 6% of Total Indirect & Direct Costs			3,354,268
Engineering (Design) @ 6% of Total Indirect & Direct Costs			3,354,268
Total Cost			62,613,006
Overhead @ 41.58% PGDP Personnel			740,052
Overhead on Indirect Costs @ 7.62%			879,031
Total Cost with Overhead			64,232,090

Escalated Cost [b]	
FY 2001	$21,621,912
FY 2002	$21,971,997
FY 2003	$22,433,409
Total [c]	$67,263,606

[a] 3-year duration for project execution / 30-year nickel ingot storage
[b] Escalated at 2.1% per year
[c] 30-year duration for project execution (storage of nickel ingots)

F.2. BASIS FOR COST ESTIMATE

F.2.1. LABOR PRICING

The hourly wage rates used in the cost estimate were based on the standard labor rates for Paducah. These rates are listed in Table F.3.

Table F.3. Standard Rates

Code	Participant/Craft	$ Rate/Hour
21LABOR	Project Controls	47.29
32LABOR	Engineering	56.91
41LABOR	Procurement	40.54
52LABOR	Quality Assurance	52.48
53LABOR	Field Services	46.62
56LABOR	Security	38.45
58LABOR	Environ H&S	54.37
EH_TEC1	SEC Radcon Techs	50.00
51LABOR	Project Management	85.76
59LABOR	BJC Management	101.12
E	Electrician	34.65
OP	Operating Engineer	30.95
L	Laborer	24.85
TD	Truck Driver	22.60
AL	Asbestos Laborer	24.85
BM	Boilermaker	42.00
M	Brickmason	29.95
C	Carpenter	31.15
F	Cement Finisher	27.65
IW	Iron Worker	37.55
MW	Millwright	31.75
P	Painter	27.55
PF	Pipefitter	35.20
R	Roofer	24.60
SM	Sheetmetal Worker	38.75
SF	Sprinkler Fitter	34.00
AW	Asbestos Worker	52.50

F.2.2. MATERIAL PRICING

Material pricing was based on vendor quotes, recent similar job history, and best estimator judgment. Procurement of a shredder is included in the estimate. Material handling equipment would be rented as needed.

F.2.3. OVERHEAD AND SUBCONTRACTOR MARK-UP

The PGDP site overhead cost is applied to all PGDP labor and material. This overhead recovers costs associated with administration, facilities maintenance, plant services, corporate and central services, and general expenses. The overhead rate is 41.58% for PGDP site personnel. Subcontractor indirect costs are calculated as 26% of direct costs. Overhead is applied to indirect expenses at a rate of 7.62%. Sales tax is applied to material at a rate of 6% on material and subcontracts.

F.2.4. ESCALATION

The estimate has been escalated using DOE-approved annual rates. The estimate is based on FY 2000 costs and then escalated over the period of activity based on the assumed project schedule. The approved escalation rates are 2.1% for FY 2001 through 2006. Similarly, a rate of 2.1% was used for FY2007 through FY 2030.

F.2.5. COST ESTIMATES FOR ALTERNATIVES 2

Table F.5 show summary cost estimates for Alternative 2.

Table F.5. Summary Cost Estimate for Alternative 2

Work Breakdown Structure Elements	Labor $	Material $	Total $
Silt Fence Inspections and Replacement (average annual)[a]	0	28,993	28,993
Surveillance & Maintenance	0	171,000	171,000
Grass Mowing	0	15,000	15,000
Subtotal of Direct Costs		214,993	214,993
Burden @ 30% of Labor Costs			0
Total Direct Cost		214,993	214,993
Indirects @ 26% of Total Direct Cost		55,898	55,898
Total Indirect & Direct Costs			270,891
Sales Tax @ 6% of Total Indirect & Direct Costs			16,253
Engineering (Design) @ 6% of Total Indirect & Direct Costs			16,253
Total Cost			303,398
Overhead @ 41.58% PGDP Personnel			0
Overhead on Indirect Costs @ 7.62%			4,259
Total Cost with Overhead			307,658

Escalated Cost[b]	
FY 2001	$382,010
FY 2002	$286,057
FY 2003	$292,064
Total[c]	$12,915,738

[a] Cost reported is an annual average cost of three years of silt fence maintenance and inspection
[b] Escalated at 2.1% per year
[c] 30-year duration for project execution

F.3. COST ESTIMATION

In the development of the preferred alternative, various conditions still remain unknown. The following assumptions were developed to address these unknowns:

- The project will require a maximum of 46 months to complete. Work will be scheduled to maximize continuity of removal activities and minimize transport container requirements and costs.
- A density of 42 lbs/ft^3 was used to calculate scrap wood disposal volumes. A scrap density of 165 lbs/ft^3 was applied to published classified aluminum ingot tonnage to calculate disposal volume. For all other scrap material a density of 65 lbs/ft^3 was applied to published scrap tonnage to calculate scrap metal disposal volumes.
- Rail upgrades of approximately 1,900 linear feet of track will be performed to allow for transport of scrap material by railroad car.
- A pole barn type structure with sufficient area to contain the C-746-H4 Scrap Yard nickel ingots will be erected within the PGDP security fence. This structure will meet the requirements of DOE Order 435.1.
- Material will be spread, sorted, inspected and segregated prior to processing. Any regulated material (TSCA, RCRA, ACM, etc.) discovered during scrap processing will be collected, characterized and compliantly managed.
- It is assumed that 50 ST-1 containers (4,800 ft^3) of LLW RCRA- and 50 ST-1 containers (4,800 ft^3) of LLW TSCA-regulated materials will be discovered during scrap sorting.
- It is assumed that 1 ft^2 per ton of material will require surface decontamination to meet applicable disposal requirements.
- Costs for disposal of any secondary wastes generated will be captured within the disposal costs for the discovered 100 ST-1 containers of LLW RCRA and TSCA wastes.
- Scrap metal will be shredded to a size of about one inch wide by two to three inches long to allow for use of automated radiological monitors. Shredding rates are based on manufacturers specifications.
- Samples will be collected from processed scrap allowing for characterization of each shipping container. It is assumed that one composite sample will be collected from each container.
- Classified scrap metal will be sampled and packaged for shipment but will not be shredded. Scrap metal processing of classified material will be conducted behind a security fence and within a fabric-coated tension structure in compliance with an approved security work plan.
- Intermodal and sealand containers will be loaded onto rail cars and transported to the appropriate disposal facility. This activity will ensure compliance with applicable transportation laws, regulations, licenses, procedures, and waste acceptance criteria.
- An automated radiological monitor will be used to screen and segregate non-classified scrap material for onsite and offsite disposal.

- It is assumed that 50% of non-classified scrap that will be disposed of in the C-746-U Solid Waste Landfill. Scrap material not eligible for disposal in the C-746-U Landfill will be disposed of in an appropriate facility.

- The PGDP Landfill will have adequate disposal capacity. No costs will be collected for disposal of material at the PGDP Landfill.

- Adequate storage capacity exists at PGDP for wastes for which no disposal facility is available (i.e. classified mixed waste, classified RCRA waste, or PCB low level radioactive waste).

- Scrap material will be loaded and transported from the PGDP to appropriate disposal facilities. Reusable intermodal containers and sealand containers will be used and each container will be loaded with a maximum of 18 tons and 24 tons, respectively, of scrap material.

- Sealand containers will be used to transport classified material for disposal. For security purposes the material will remain in the sealand containers for burial.

- Rail/truck transport will be used. Each rail car will transport six intermodal or sealand containers. Each truck will haul two intermodals or sealand containers.

- It is assumed that surface decontamination performed onsite, will utilize CO_2 Pellet Blasting technology to minimize secondary waste generation.

- Surplus motor vehicles and contaminated fork trucks will be sorted, sized, decontaminated if required, processed if required, radiologically segregated, and characterized to meet the WAC for an appropriate disposal facility.

- Approximately 542 tons of radiologically contaminated wood scrap stored at the Scrap Metal Yards will be characterized, size reduced, and disposed of at an appropriate disposal facility.

- Additional scrap material encountered during execution of the removal action will be processed and disposed of as part of this project.